THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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	Page
Personal Control	321
British-Made Half-Watt Lamps	322
Traffic Developments in Berlin	322
The Lead Position	322
Increasing Frequency by Static Transformers (*illus*)	323
The Condenser Machine (*illus.*)	323
The Electric Drill	324
Catalogues and Process Blocks	325
New Electrical Devices, Fittings and Plant (*illus.*)	326
Electricity Supply in Dover (*illus.*)	329
The Five-Day Week	330
Correspondence—	
Conservation and Waste	331
A Question of Etiquette	331
Lightning	332
Shift Engineers: A Proposal	332
Business Notes	333
Electrical Locomotives of the Lötschberg Railway (*illus.*)	339
An English-Built Electric Truck (*illus.*)	342
Wireless Train Control	343
Reviews	344
Notes	345
City Notes	347
Stocks and Shares	350
Market Quotations	350
Share List of Electrical Companies	351
Exports and Imports of Electrical Goods during July, 1913	353
New French Car-Lighting Dynamos (*illus.*)	354
Central Station Advertising	356
The Electrical Work at the Physikalisch-Technische Reichsanstalt, Charlottenburg, in 1912	356
The Fuller Block Accumulator (*illus.*)	357
American Insulator Manufacture	358
Foreign and Colonial Tariffs on Electrical Goods	359
New Patents Applied For, 1913	360
Abstracts of Published Specifications	360
Contractors' Column	Advertisement pages xxiv and xxvi

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PERSONAL CONTROL.

IN the earlier days of engineering there would have been no necessity for the following remarks; at the present day, however, we are constrained to suggest that engineers may possibly be tempted by the presence of the large range of automatic apparatus for recording and indicating all kinds of mechanical and electrical phenomena, to relax the endeavour to exercise that strict personal control over the operations of an engineering installation, which is even now so necessary to secure proper working results. A brief survey of some of the better known and more commonly used indicating and recording devices will illustrate the point. Taking an electric generating station, for example, one may obtain automatic tell-tales as to the percentage of carbon dioxide in the flue gases, the frequency of firing when the boilers are hand fired, the state of the smoke stack, the pressure of steam, the quantity of feed water passing at any instant, the rate of flow of steam to the engines, &c. In the engine house, automatic indicators and recorders can be applied to high pressure, intermediate pressures, and vacua, number of revolutions, if required, temperatures at critical points of an engine, and the operation of auxiliary plant. The switchboard presents a panoply of recording and indicating instruments that are necessary to a very great degree, although it may be claimed that on some of the more elaborate boards refinement is carried to excess. Sub-station indicators, spark gap discharge indicators, and other automatic devices further safeguard the system, and it is possible in a comparatively easy way to enable most of these indications to be carried to a room entirely separate from that containing any machinery whatever. In some of the larger power installations, the detached control room is becoming a feature, and if the system is not carried to excess, it proves most valuable.

At the same time a danger lies in the fact that an engineer having available at his elbow when sitting at a desk all these means of checking the functioning of the various portions of the plant, is tempted to rely more and more on these automatic indicators, and less and less on his own personal inspection and investigation gained by frequent and vigilant tours throughout the works. At this point remote control, using the term in its widest sense, becomes a snare. It is, of course, a reasonable thing to say that the best ganger never handles a spade, and therefore the engineer who can see furthest, and carry on the general operations of the plant in the best manner, must not occupy his time with cumbersome detail checks of a personal nature, but that is only one side of the shield. The other is that of the man whose drivers rarely see him, and who, therefore, either waste oil in their engines or cut down the oil to such an extent that their bearings seize. It is a case of the man who never goes into the stokehold, and whose stokers, therefore, please themselves as to how they fire the boilers.

The personal element of control is absolutely essential to avoiding those petty differences between one man and another that go so far to lessen the efficiency of a station staff, and while the expert organiser can learn very much from his automatic indicators, using them simply as a guide and an argument, the successful power house engineer is a man who knows how to feel the big-end without falling into the engine, and who can, if necessary, pick up a shovel and show how a peak-load fire can be kept up on slack. He does not need to spend all his time doing this, but a comparatively little time adequately employed will earn a tremendous amount of respect and efficiency. In addition to this, it will teach the chief engineer a good many things about his plant that his indicators and recorders will not tell him. It will, for example, let him know whether the cotton waste is gritty, and will probably explain some of the minor breakdowns. It will probably teach him a good deal more quickly than differential calculus the precise price per ton of coal which means minimum cost per unit, and it will make a man and a brother of the coal trimmer.

Personal control in power-house operations is a thing that is not to be despised. In times of emergency men will always do more for the chief when they know something about him to his advantage than they will for a man who rings up on the telephone from the city office, and in these days when the business-getting side of electricity supply is being so much insisted upon, it may be worth while counterpoising the tendency by advocating a return, to a certain extent at any rate, to the older type of chief engineer, who knew how to distinguish between a spanner and a tommy-bar.

British-made Half-watt Lamps.

ON Wednesday last a Press view was held of the first "half-watt" lamps made in this country. It is interesting to note that this lamp, of which much has been heard from time to time from Continental sources, originated in the research laboratory of the British Thomson-Houston Co.'s associates at Schenectady, New York, under the direction of Dr. C. W. Witney, where a series of investigations has been taking place during the past two years. The lamps which were shown in operation were produced at the B.T.H. Co.'s works at Rugby, and they will, it is expected, be commercially available in about three months' time; running on 80 volts they give, roughly, 1,600 C.P. with 10 amperes, and as series lamps for street lighting purposes, they appear, at the moment, likely to have the field very much to themselves.

Traffic Developments in Berlin.

THE severity of motor-omnibus competition in Berlin is being experienced in a similar manner to that which prevails in London, although initial steps are now being taken with a view to overcoming the difficulty. As far as can be understood from the existing state of affairs, the principal sufferers from the rivalry are the Grand Berlin Tramways Co. and the Berlin Underground and Elevated Electric Railway Co., which also compete with each other along certain routes. The congestion of traffic in the inner parts of the city is so great that tramway expansion is declared to have reached its maximum limit, and in some quarters the opinion is even entertained that the time is not far distant when it may be necessary to take into consideration the question of partly suspending the tramway service in the city in the interests of traffic in general, after the example, it is said, of other capitals (!) In this event the motor-omnibuses would be required to form the connecting link between the tramways. However that may be, the Underground and Elevated Railway Co. has decided to acquire a large interest in the omnibus company by taking over shares of the nominal value of £200,000 and at the price of 180 per cent., and the tramway company has felt constrained to follow the example by the assumption of a financial interest of equal amount, both transactions being rendered possible through the shares held by their banking interests as represented by the firm of Bleichroder and the Deutsche Bank respectively. Apart from loans, the only outstanding share capital of the omnibus company on the completion of the transactions in question will be £200,000 nominal, but it is not expected that either the tramway or the railway company will endeavour to obtain possession of these shares so as to secure a majority control over the omnibus undertaking. On the contrary, it is rather thought that efforts will be made to bring the present triangular duel to a conclusion by the negotiation of working agreements for the avoidance of destructive rivalry in the future, and the hope is expressed that any such understanding, whilst of advantage to the undertakings directly concerned, will not be disadvantageous to the general public.

The Lead Position.

THE course of lead prices has been rather irregular, with an occasional further easing down, more particularly for near deliveries, although the arrivals from abroad since the early part of the month have been decidedly limited again. As regards forward deliveries, however, the position has not improved at all, for the latest news is to the effect that a serious labour outbreak has occurred in the State of Missouri, which is responsible for an annual output of 140,000 to 150,000 tons. This introduces another complication into a market already vexed by the suspension of production at the leading Mexican properties, and in that country there is not the smallest indication of any improvement. On the contrary, news to hand from private sources is, if anything, rather worse than before. The North American Continent seems, indeed, to be afflicted with unrest of one sort or another, which is especially marked in metal circles, this arising, no doubt, from the exceptional activities of the Western Federation of Miners, who put a stop to mining and smelting operations throughout the entire Lake Superior copper region, and who have now caused a suspension of operations in the Missouri lead fields.

The state of affairs in Mexico is now commencing to show itself in the shipments from that country. Our imports from there during July only amounted to 286 tons, compared with 1,295 tons in the previous month, the total for the seven completed months of the year reaching 9,614 tons, compared with 11,901 tons in 1912, while the shipments from the United States to Europe consisting of Mexican lead treated in bond, amounted for the first half of the year to 24,037 tons, compared with 29,476 tons a year ago.

The United States lead smelters look like being very seriously hampered in their operations, for not only is the Mexican raw material cut off, of which upwards of 70,000 tons a year annually are treated in United States plants, but the Missouri trouble wipes out a yield about double as large. It seems too much to hope that the troubles across the Atlantic will not be felt here, more especially on the West Coast, for, in the ordinary course of events, a good deal of lead is shipped from North America to Glasgow, Liverpool and Manchester. The interruption of shipments to these important consuming centres is not to be regarded with indifference so far as prices are concerned. The only thing in favour of lower lead prices at the present time seems to be the cheapness of spelter, which encourages its use in place of the heavier metal.

There is a chance of more ample supplies coming forward from certain of the other important producing countries, and it is upon this that the hopes of consumers must chiefly rest. Both Australia and Spain have yielded more freely this year than last, their combined shipments showing an increase of about 20,000 tons, but the overseas trade has absorbed the whole of the surplus quantities which have been rendered available.

The technical condition of the lead market is now one of considerable strength, but it is believed to be the policy of the controlling parties not to force prices up, but rather to keep them down lest consumption be damaged. In the meantime there is a fair sized "bear" account open, and the covering of this may put rates up further.

INCREASING FREQUENCY BY STATIC TRANSFORMERS.

By S. M. POWELL.

One method which has been employed to increase the frequency of an alternating current is illustrated in fig. 1. The primary alternating current is carried to two windings *a a* wound in the same sense on two transformers, while an auxiliary magnetising current is supplied to windings *b* wound in opposite directions. In the secondary alternating-current circuit *d*, connected to the windings *c c* (oppositely wound), there is then produced alternating current of double the supply frequency. By representing the intensity of the secondary current graphically as a function of the self-induction L in the secondary circuit, a resonance curve is obtained. The inductance L is, in turn, a function of the magnetic properties of the transformer core which naturally varies with the magnetising current in the auxiliary windings. By suitably adjusting the secondary resistance, inductance

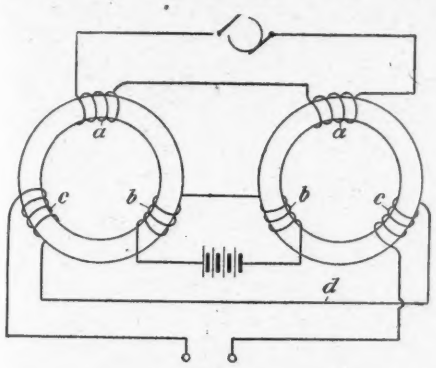


Fig. 1.

and capacity, it can easily be arranged that the secondary current varies in the neighbourhood of the resonance peak, hence the secondary current can be varied within large limits by comparatively small variations in the auxiliary magnetising current, and this fact forms the basis of an analogous method, recently patented by the Gesell. für Drahtlose Telegraphie (see also *La Lumière Electrique*, 23, pp. 20-23), for the production of high-frequency current for use in wireless work. By variations in the auxiliary magnetising current, obtained, for instance, by the manipulation of a resistance in this circuit, the secondary can be tuned accurately to the frequency imposed upon it.

The same phenomenon can be utilised to produce from low-frequency alternating current, high-frequency current of such frequency that the signals received at the far station

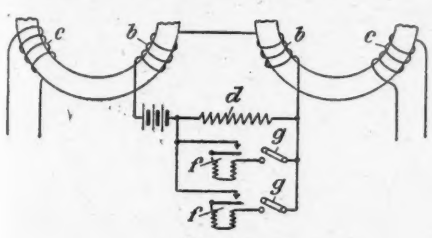


Fig. 2.

can be heard as musical sounds in telephone receivers. For instance, a resistance *d* (fig. 2) may be inserted in the magnetising circuit, and in parallel with this one or more periodic interrupters *f* having the frequency desired. The latter may be placed in action by the switches *g*, thus producing distinct and definite musical radiations. The resistance *d* is so chosen that the secondary current attains as nearly as possible its maximum resonant value when *d* is short-circuited by *f*, and falls as far as possible down the ascending or descending slope of the resonance peak when *d* is inserted in the magnetising circuit. The interrupters *f* are so arranged that the circuit is closed for a longer period than it is opened, and, instead of mounting them in parallel with resistance, they may be used to open and close the magnetising circuit. Fig. 3 shows the resistance *d* shunted by a key *h*. Yet another alternative is to superpose a low-frequency alternating current of suitable intensity on the magnetising current, the net value of which thus varies between the limits corresponding to maximum variation in the secondary current. Going yet further, the continuous magnetising current may be entirely suppressed in favour of a low-frequency alternating current.

In telegraphic installations, *g* (fig. 2) is a Morse key, but in telephonic equipments the variations in the microphone resistance are made to vary the magnetising current, and thus produce corresponding but augmented variations in the high-frequency aerial current. The single group of transformers shown in fig. 1 doubles or trebles the primary

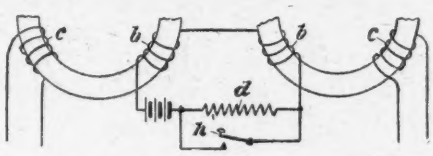


Fig. 3.

frequency, but by connecting a number of such groups in cascade (the secondary current from one group being used to excite the primary of the next group), any desired overall increase in frequency can be attained. The transmitting key and tuning adjustments are placed in the magnetising circuit of the last (highest frequency) group of transformers. If it be desired to eliminate the special magnetising windings *b*, *b*, the direct-current battery and control circuit is connected to the primary or secondary windings *a* or *c* through reactance coils, preventing the flow of high-frequency currents through the magnetising circuit.

THE CONDENSER MACHINE.

[BY OUR BERLIN CORRESPONDENT.]

The condenser machine invented by Dr. H. Wommelsdorf is a new electro-static machine for the direct generation of high-tension continuous current. While its principle was described some years ago in the scientific Press, it has only recently been so improved as to become suitable for practical use in X-ray and other work.

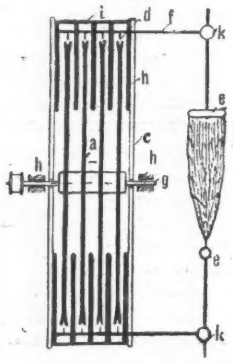
The characteristic feature of this machine is the alternating arrangement of the rotary and stationary disks, which is based on the condenser principle. It will be remembered that in an influence machine the rotating disk is only influenced on one side, the generated electricity being drawn off from the other. The rotating disks of the condenser machine, on the other hand, undergo electrostatic induction on both sides, the electricity produced in them being collected from a groove in their extreme periphery by steel wires penetrating therein. It will thus be seen that each disk, in accordance with the theory of condensers, takes up and supplies twice as great an amount of electricity as an influence machine. Actual experience, moreover, shows that the output of the new machine, thanks to some additional advantages connected with the condenser principle, is even considerably higher than could be expected. It is mainly due to the close arrangement of the disks that the condenser machine yields an amount of electricity 20 to 50 times as much as a Holtz-Wimshurst multiple-disk influence machine of equal size, the type so far almost exclusively on the market. Another point of considerable importance is that the condenser machine is absolutely independent of atmospheric conditions.

The sectors of the condenser machine are not attached to the surface of the disks, but embedded in their interior, thus augmenting the output, pressure and self-excitation of the machine, and increasing the life of the disks. In fact, the unceasing inflow and outflow of high-tension electricity from the suction combs, brushes and sectors to the insulating disks was bound in a very short time to destroy even the best insulating material. The stationary disks of the

machine are likewise entirely encompassed by insulating material.

The condenser machine mainly comprises a substantial frame closed on all sides which carries in its interior the statical fields, that is, the stationary disks. The rotating disks above described, to which is due the influence effect, are sandwiched in between these fields, thus being also comprised in the interior of the frame. This compact arrangement protects all vital parts of the machine not only against dust, but at the same time against radiation losses which would otherwise be an important item.

That this remarkably simple and efficient machine—as it were, a continually charging and discharging condenser—should have had to wait a number of years before being placed on the market, was due to some drawbacks of its original construction and to the fact that no insulating material suitable for the purpose could be found. In fact, the effects of the electricity and ozone produced by the condenser machine are, just because of its extraordinary



a, Rotating disks; *c*, end cover; *d*, collector; *i*, frame; *e*, electrodes.

Section of Condenser Machine.

output, so powerful that rubber, a substance that could not be dispensed with on account of the high voltage of the machine, would become conductive after a very short time.

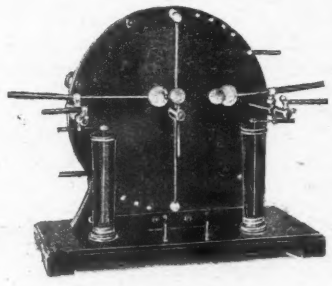
The adoption of a certain brand of Bakelite with which the caoutchouc disks were coated all round first made the condenser machine durable and suitable for commercial purposes. This Bakelite layer—insoluble and brilliant as enamel—endows the disks with a remarkably hard surface, and can only be removed by scraping with a knife, in the form of an amber-like yellow powder.

The arrangement of the current collectors at the extreme circumference of the disks has enabled the spark length of the condenser machine to be increased to twice its former value, thus allowing sparks considerably longer than half or even two-thirds of the disk diameter to be produced.

The condenser machine will be found an extremely useful apparatus for X-ray work, affording, as it does, a means of producing high-pressure continuous current directly without any conversion, rectification, &c. This allows hand operation to be used in the case of moderate effects, while increasing the life and constancy of X-ray bulbs, the more simple of which can be used without cooling, thus cheapening operation. Wherever there is no suitable electricity supply, *e.g.*, in the case of portable installations for military and other purposes, the condenser machine will afford an ideal means of operating X-ray apparatus. It will also be found useful in cases where only an alternating or three-phase current supply is available, which could not be used without resorting to converters, rectifiers, &c. Apart from hand operation, a small continuous, alternating, or three-phase current motor (of $\frac{1}{8}$ H.P.) can be used to drive it. The output of a motor-driven condenser machine having a single rotating disk 55 cm. in diameter is as much as $\frac{1}{2}$ milliampere. Machines comprising four, eight or ten rotating disks, such as have been constructed, show a correspondingly higher output.

Another field in which the condenser machine is bound to prove of the greatest usefulness and to excel all other apparatus so far in use, is the field of electrotherapeutics, viz., the medical applications of electricity. An especially important feature in this connection is that the output of the machine can be controlled at will and reduced to zero, the current intensity being proportional to the number of turns per second. This is an enormous advantage over powerful induction coils, which cannot be used for small outputs.

If, for instance, the electric currents yielded by the machine be applied to the human body, their physiological effects can be altered quite gradually and controlled at will, from a hardly perceptible shiver up to an unbearable



The Condenser Machine.

intensity. At the same time, the operation of the machine is absolutely safe and harmless, the upper intensity limit being readily adjusted for by choosing a proper size of Leyden jars.

The machine also comprises two special terminals from which alternating currents or rapid oscillations can be collected for high-frequency current work and for performing the methods devised by Oudin, D'Arsonval, Apostoli, &c. The same large condenser machine also lends itself for franklinisation proper, that is, for static electricity treatment, and for experiments with the insulating stool.

The high pressure of the machine is noticed at a considerable distance by a spider-web feeling due to electrically-charged particles. These remote effects can be strikingly demonstrated by lighting Geissler and Tesla tubes from a great distance.

The exceptionally high Leyden jars used in connection with the condenser machine are countersunk in its base, and are, like the disks, coated with Bakelite. The polariser at the same time serves as short-circuiter, for rapidly and accurately breaking the flow of sparks.

Though the machines so far constructed are doubtless the starting point of types much larger and more powerful, they are able to comply with the most exacting requirements of X-ray work and electrotherapeutics.

The condenser machine is constructed by Messrs. Berliner Elektros. G.m.b.H., of Schöneberg, near Berlin.

THE ELECTRIC DRILL.

A great many difficulties have arisen in the practical application of electricity in a direct manner to the operation of drilling stone and rock, and it is, therefore, a matter of congratulation that so much progress has already been made in this direction. The use of electric drills allows in many cases of the purchase of power from electric transmission companies at low cost, and the elimination of the expensive steam and air pressure plants usually required in connection with hydraulic or pneumatic drills. Where energy cannot be purchased, a small generating plant can be installed at a comparatively small cost, and the ease with which power can be transmitted throughout the mine workings by wire, and the rapidity with which the lines can be changed to suit the varying conditions, allow the mine operator to advance his work much more rapidly than can be done when using other types of drills. The small cost of installing and maintaining the electric wiring, the absence of leakage and the ease with which lines can be changed, show a large saving when compared with pneumatic lines.

A type of electric drill which has proved its value is that made by the Fort Wayne Electric Works, of Madison, Wisconsin. In general construction the drill is of the rotary hammer type,

operated by an electric motor which is mounted on the frame of the drill. The mechanism of the drill itself consists of two parts, one being a rotating helve containing the hammers, the other a chuck mechanism for holding and rotating the drill steel. There is a flexible belt connection between the motor and drill, allowing a suitable speed variation. There are no springs, solenoids, or other devices to complicate the design or to make the cost of maintenance too high. The drill mechanism is altogether enclosed inside a heavy cast-steel casing, strong enough to stand up to the hard usage which a mining drill of this type receives. There are two chambers in the revolving helve, in each of which there is a hammer consisting of a solid block of special steel floating freely. As the helve revolves, the hammer is thrown outward by centrifugal force, and at each revolution strikes a blow on the projecting head of a drill steel cap, which receives the energy of the blow and transmits it to the drill steel. After the blow has been given, the hammer rebounds into the chamber within the helve, where it is completely cushioned upon air which it traps. During the recoil of the hammer the helve is, of course, revolving, and the hammer passes the projecting drill steel cap. The hammer is again thrown into the striking position by centrifugal force during the remaining portion of the complete revolution of the helve. The chuck is a steel sleeve through which a shank of the drill steel passes, and holds this in position to receive the hammer blow, as well as transmitting the rotary motion. This rotation is effected by a heavy wormgear reduction driven from the helve shaft. A slip friction cone mounted on the wormgear shaft protects the gears from undue strain, in case the drill steel sticks. Buffer plates are attached to hold the drill steel in the chuck and to absorb the blow from the hammer when the drill steel is not striking rock, or is being backed out of a deep hole in broken or uneven ground. Grease packed roller or ball bearings are used; the motor is fully enclosed and splash proof, so as to be capable of operation in wet places, and either continuous or alternating-current motors can be used, for three-phase circuits of the usual frequencies in the latter case. The motor is quickly connected to the line by connector plugs, so designed that the untechnical operator cannot make a mistake in the connections. A 100 per cent. over-load margin is given to the motor design, and very great care is taken also with the motor to withstand the severe mechanical strains imposed upon it from time to time. The whole apparatus is mounted either on a tripod, column, shaft bar or quarry bar, and, when so used, is adapted for sinking, channelling, stoping or other operations where rock drills are required. The chief working advantages are that the drill steel is not reciprocated, and hence cannot be jammed into a fissure or cleavage crack. The large number of blows which are struck, together with the constant and positive rotation of the drill steel, produces an effect approaching that of boring and the holes drilled are straight and round. Owing to the rapidity of the blows, it is found in practice that before it can be fed far enough into a fissure to wedge itself the drill has hammered for itself a square shoulder or face, and should a fissure be encountered the buffer head prevents the drill steel from being plunged forward. Evidently, therefore, the electric rock drill is an accomplished fact, and in yet another department of industrial life the practical application of electricity enters into direct competition with the older forms of power production and transmission.

CATALOGUES AND PROCESS BLOCKS.

By G. BASIL BARHAM, A.M.I.E.E.

In the electrical trade it is a matter of great difficulty for any firm to do business unless it issues a fairly comprehensive and well-illustrated catalogue. No matter how widely the firm and its productions may be known, or how capable and tactful its representatives may prove themselves, the business obtained will depend to a considerable extent on the attractive appearance of their lists and leaflets and the freedom with which they are distributed.

A great deal of money can be wasted on catalogues if a cheeseparing policy is adopted and the expenditure on paper, printing and process blocks is insufficient. The slight extra cost involved by using an 80 instead of a 58 or 60-lb. double medium art paper is more than repaid by the enhanced appearance of the work, provided that a good quality of ink is used for the printing. If more money still is spent and an art or toned art paper, a ream of which in double medium size weighs 120 lb., is used the effect is better still, and if the printing is up to the mark and the blocks or electros used are of the best quality, a catalogue can be brought out which will prove one of the most powerful of selling agents that can well be imagined. It is a mistake to save money in paper and printing; it is a bigger mistake still to cut down the price of retouching photographs and cutting blocks. A block may be so good that it will give a good effect even on poor paper, provided the printer makes-ready properly. But no amount of care in printing will make a bad block appear good, even if the best of paper and the finest of inks be used. An artistic, clean cut and sharply defined illustration has a value which cannot be over-estimated, and it is surprising to find, from an inspection of catalogues issued in the engineering trades generally, not only that a number of firms buy process blocks which are not so good as they might be, but that there are those who apparently take little or no care of their blocks after they are made. A good block, taking photographing, retouching, block-cutting and electrotyping into account, is a costly item, being not a matter of shillings, but actually of pounds. An instrument or a piece of office furniture costing as much would be taken care of, yet it is a common thing to see half-tone cuts placed one on top of another, on a dusty shelf, covered with grit and dirt, and not protected against injury in any way. The surface of a block is of copper, or sometimes zinc or nickel, covered with an emulsion. The glass-like polish of an unworn block will withstand the pressure of the printing press for many thousands of runs, as it is termed, but it is not proof against sharp particles of grit; it will be grooved and scratched if it is allowed to rub against the surface of another block; and it may be irretrievably damaged by being used either as a paper weight or as a means of driving tacks.

Of course there are cases, but in the electrical and engineering trades they are infrequent, when a block, after printing off a limited number of illustrations, is never used again by reason of changes in the pattern of the article it represents. Generally, however, illustrations are typical, and consequently are used in successive editions of a catalogue. In such instances it is surely wise to see that the blocks are preserved, so that it is not necessary to have a new block made every time a few lists are to be printed off.

The best plan to adopt is to have one or more good electrotypes made from the block when it is new and to print off these, carefully wrapping the original in tissue paper smeared with vaseline or other non-acid grease, and putting it safely away where it will not be exposed and yet can be readily looked up if necessary. Some firms prefer to print direct from the half-tone block, a policy which although it has certain drawbacks has nevertheless much to commend it. If the printing is done from an electro it matters very little if the electro is damaged in the press, as a new electro can always be made in a few hours from the original. But if the original is used it may be ruined beyond redemption if the machineman drops a wrench on it during the work of "readying" the machine for press, or by the forme in which it is being dropped whilst being taken from the "stone" to the machine bed. Where printing is done from originals an electro should be taken from the block either by the block cutters before delivery or by some firm of electrotypers directly after delivery, and this electro should then be treated as the original and wrapped up and stored away out of harm's reach.

It is not as though the proper care of process blocks and electros were either costly or troublesome. With a proper system, an intelligent boy can easily look after them and save his firm a good deal of expense. Without a system it is almost impossible to keep them as they should be kept, and the block-cutting firm will then do a considerable amount of business in providing duplicates of originals of the electros that have been mislaid or lost.

All process blocks and reproductions should be kept in shallow drawers, a trifle more than type high. A nest of such drawers is quite inexpensive, and if there should be any difficulty in obtaining one, a handy carpenter can knock one together, preferably out of bass or American white wood, with very little trouble. Such a nest of drawers will answer the requirements of a firm issuing only a small catalogue, but when lists are issued on a more extensive scale several nests, each corresponding to a section of the catalogue or a branch of the trade, will be required. In addition to the drawers a card index will be necessary

Each block, when it comes from the block cutters, will be mounted on a hard wood base, generally of oak or mahogany, and from the base to face will be about the height of a piece of type, so that when it is locked in a printers' forme with the type for the necessary wording the whole will be level on the top, and, after the printer has made the necessary arrangements for bringing out the detail, ready for printing. On this wood base a number should be written in ink. It is of little use attaching paper labels, as these are so easily detached, nor is it wise to write the number on the back of the base, as after a few printings the wood will become compressed to a slight degree, and the printer will proceed to paste paper over the bottom of the base in order to raise the printing surface. The numbering should be done on the side of the block, and if there is any likelihood of the printer mistaking the top for the bottom, the block should be marked to prevent error.

The numbers of the blocks in each drawer should be written on the outside to permit of ready reference, and a card in the index should be prepared for each block. On this card should be written the block number and the name of the article it represents, with any descriptive matter as to type or pattern that may be necessary as well as the figure number it bears in the catalogue. The card should then be divided into an inwards and an outwards section by a heavy line, and should be ruled off horizontally in spaces about a quarter of an inch in depth so that the necessary entries can be made.

When a block is received from the etchers, the full description should be entered up on a card, and on the first horizontal space on the inward side, should be written the date received. This should be a white card, and immediately behind it in the index should be arranged coloured cards, made out in exactly the same way, one for each electro that is made from the block. As either originals or electros go out the cards should be entered up with the outwards date and the name of the printer to whom the block or the electro has been sent, or the name and address of the client to whom it has been lent. When it is returned the date on which it was received should be entered on the inward side, with the name of the firm from whom it was returned. At any moment, then, the cards can be gone through, and outstanding blocks can be traced and their return asked for without trouble

Whenever a block goes out it is a good plan to place a slip of card bearing its number in the place from which it has been taken, so that a glance through the drawers will show which blocks have gone. Otherwise, if a drawer were not full, there would be nothing to show whether there had ever been a block in the vacant space.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Reyrolle Flat Back Switchgear.

Figs. 1 and 2 show a three-phase low-tension switchboard recently manufactured by Messrs. A. Reyrolle & Co., Ltd., of Hebburn-on-Tyne, for use in a generating station, with slabs of white polished marble on angle-iron framework; fig. 1 shows the front view, and fig. 2 the view behind the board. The views are of interest as showing that Messrs. Reyrolle do not confine themselves solely to their totally enclosed ironclad gear.

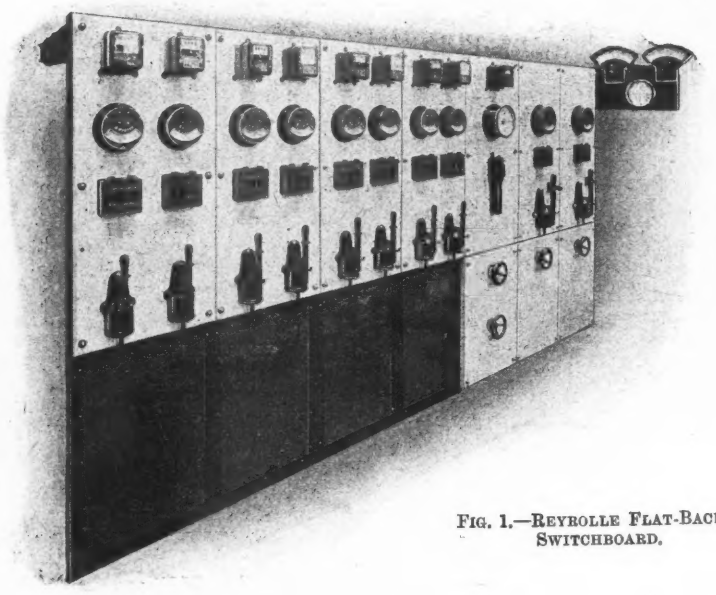


Fig. 1.—Reyrolle Flat-Back Switchboard.

Fig. 2.—Back View, Reyrolle Switchboard.

The gear shown is used in these cases where economical considerations as to initial cost do not warrant the complete enclosure of all conductors. The conductors at the back are all visible and coloured, to indicate the phase to which each one belongs, and no live conductors are exposed in the front.

The bus-bars are supported on the firm's special bracket, and consist of laminated strips made in unit lengths, so that any section of bar or any arrangement of tapering the section can be readily adopted; the section of the bars can also be easily increased when the board is extended, and there is no difficulty in joining up new lengths of bus-bars to the original ones.

Some Theatre Fittings.

Messrs. David Shanks & Co., Ltd., of 115, Wainwright Street, Aston, Birmingham, have recently introduced a special line of fittings for picture houses, theatres, and similar buildings, of which we reproduce some representative examples.

Fig. 3 is a design specially adapted for low ceilings. It is a 16-in. cast metal-metal ceiling fitting, the lower band being in the form of a shade carrier, which is suspended from the ceiling plate by three rings and hooks, as shown in the illustration. This fitting is designed to take one 100-c.p. metallic-filament lamp, and one 8-c.p. ruby lamp, operated by two switches.

Fig. 4 is an Ormolu two-light flambeau bracket, which is very popular in some of the better-class picture houses and theatres; it is made in various finishes, the most liked being rich gilt or oxidised silver.

Fig. 3.—Low Ceiling Fitting.

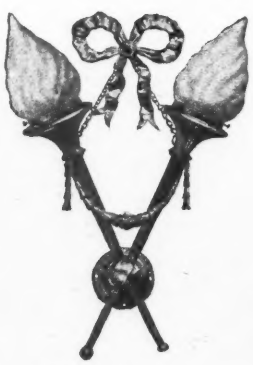


Fig. 4.—Two-Light Flambeau.

Fig. 5.—Hall Lantern.

Fig. 5 is a Louis XV hall lantern; it is solid cast, beautifully chased, and a rich gold colour. It is one of a range of fittings of similar designs installed by Messrs. Shanks in various picture theatres throughout the country.

Fig. 6 is a good specimen of the latest semi-inverted fittings. It has a cast ceiling-plate with three hooks, and the metal rim is large, half ball pattern, with fancy cast lugs, and carries a real green alabaster bowl 12 in. in diameter. The veining of this alabaster is exceedingly pretty, and when the lamp is switched on is very effective. This pattern is one of a large range of designs of alabaster bowl fittings which Messrs. Shanks manufacture from 8 in. up to 24 in. in diameter, and different coloured alabasters can can be supplied, including green, white, red, clear, &c.

Messrs. Shanks claim to be among the pioneers of the scientific lighting of picture houses, and their fittings have been adopted very widely for this class of work. They are amongst the largest

Fig. 6.—Semi-Inverted Ceiling Fitting.

manufacturers of fittings for Holophane glass, and are generally prepared to execute almost anything in the way of decorative fittings.

"Calor" Heating and Cooking Appliances.

From the very comprehensive selection of cooking and heating apparatus made by Messrs. Townshend's Art Metal Co., Ltd., of Ernest Street, Birmingham, we illustrate some examples which are likely to be of interest to our readers at the present time.

Fig. 7 is representative of a number of similar designs of electric fire constructed on the Townshend patented system.

It contains an 880-watt "Calor" heating element carried in a 14-in. aluminium or copper reflector with a polished brass stand. The heating element, which can be replaced in one piece, consists of a special alloy resistance wound in the open slots of a circular

Fig. 7.—Glowing Electric Fire with Circular Reflector.

base composed of highly-refractory clay, which quickly becomes red hot, presenting a cheerful appearance and throwing off great heat. Similar designs, but with rectangular reflectors, are also made, as well as upright "fires" in patterns which range from the very simple to the elaborate, one of which, illustrated in fig. 8 is 23 in. high by 16 in. wide, in antique finish brass.

Fig. 9 illustrates a "Tamco" oven in sheet steel with double walls, the internal dimensions being 16 in. × 16 in × 14 in. It is fitted with a 1,200-watt heating plate, removable at will, and which when removed can be used as an ordinary boiling plate. A circular plate is provided in the top of the oven, which, when removed, allows of the hot plate being inserted top downwards, thus providing an efficient top heat for browning purposes and for preliminary oven heating.

An 8-in. boiling plate, for 1,200 watts, is also provided; both plates are complete with switch for three heat regulations, and a hot chamber can also be supplied to fit on the oven top for plate warming, &c.

Fig. 10 shows the "Heetorboil" patent extending food warmer, constructed in aluminium, copper or brass, which, from 15 in.

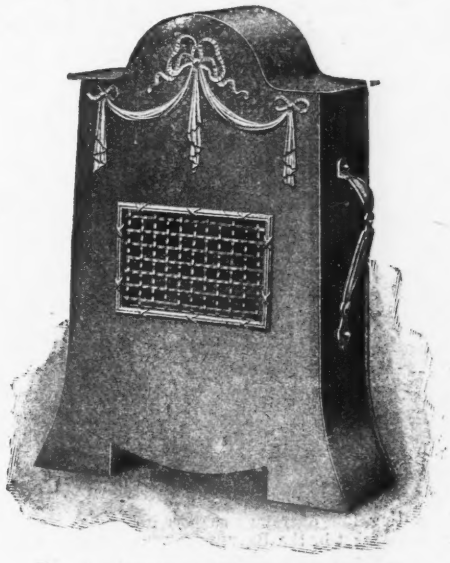


Fig. 8.—Antique Finish Electric Fire.

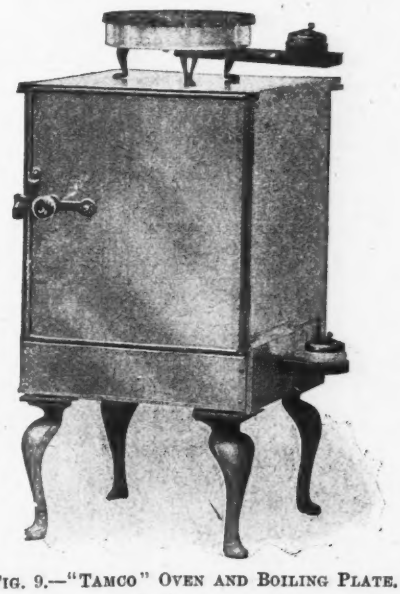


Fig. 9.—"Tamco" Oven and Boiling Plate.

Fig. 10.—"Heetorboil" Extending Food Warmer.

long × 8 in. wide, can be extended to 21½ in. long. It provides a top heat with 600 watts, and there are three heat regulations.

Boiling and heating can be done at the same time by sliding the top open to uncover the boiling place and at the same time increasing the length of the heating surface.

Non-conducting feet and handles are provided and a rack underneath for plate warming. The heating element is replacable in a

few minutes at trifling cost, and the heater can be used wherever electric light is installed; all "Calor" appliances are guaranteed for 12 months.

We also illustrate in fig. 11 a milk boiler, in polished aluminium, brass or copper, to hold 1½ pints. The top heat is obtained with

Fig. 11.—Electric Milk Boiler.

440 watts and three heat regulations are provided, the lower ones for warming. The utensils which are not attached to the stands, have either wickered or ebonised handles, and, when necessary, plated interiors. Messrs. Townshend's make a variety of cooking and warming utensils of a similar type.

B.T.H. Rotary Snap Switches.

An interesting line of rotary snap switches has recently been placed on the market by the British Thomson-Houston Co., Ltd., of 77, Upper Thames Street, E.C. In their design the weight of the moving parts has been reduced to the minimum consistent with durability and proper current-carrying capacity. This feature greatly increases the wearing qualities of the switch, by diminishing the force of the hammer blow in the "on" and "off" movements. Bases of the best quality porcelain and ebonised handles

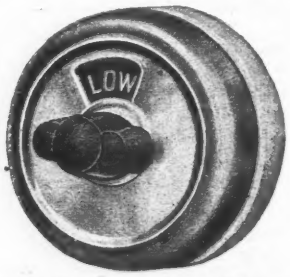


Fig. 12.—Series-Parallel Three-Heat Switch for Radiator Circuits.

with self-contained springs are used in these switches. The employment of flat binding posts gives easy access to the binding screws in however confined a position the switch may be fixed, as the screw-driver works from the front of the switch, at right angles to the wall. The danger of cutting the wires at the screw contacts is also removed.

B.T.H. rotary snap switches are supplied with nickel (fibre insulated) and porcelain covers. Single and double-pole switches, fig. 13, are made for 100-250 volts and 250-600 volts, with current-carrying capacity ranging from 3 to 20 amperes, and with or without indicating dials in the cover.

There is a three-way switch in three sizes; 3, 5 and 10 amps., 100-130 volts, or 1, 3 and 5 amps., 200-250 volts. There is also a

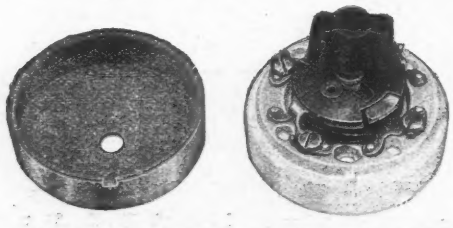


Fig. 13.—B.T.H. Rotary Double-Pole Snap Switch.

three-circuit rotary switch for automobile lighting, suitable for use on voltages up to 250, and supplied with or without an indicating dial. It is arranged with three circuits so that the head-lights, tail-light and interior lights of a motor-car can be switched on or off separately or together.

Another type—the series-parallel three-heat switch, fig. 12, provides a simple and reliable means of regulating the heat of radiators or cooking devices. It is supplied in two sizes, for 10 and 20 amperes, and can be used on voltages up to 250.

The Vancouver Telephone Cable.

We referred on page 298 in our last issue to the continuously loaded submarine telephone cable which has been laid by Messrs.

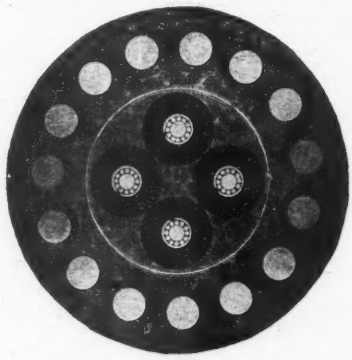


Fig. 14.—The Vancouver Continuously Loaded Telephone Cable in Section.

Henley's Telegraph Works Co., Ltd., between Vancouver B.C., and the island of the same name. The cable is the longest of the kind so far laid, and the above view, fig. 14, is a full-sized section of it.

Ferranti Transformers.

Messrs. Ferranti, Ltd, of Hollinwood, Lancs., have built transformers for over 15 years, and have continuously improved their designs and methods of manufacture at all points, so that the apparatus they now offer is the best of its kind, as may be judged from the following details.

Series of tests have been conducted to discover a suitable alloy for the core, with the result that, by careful selection, it is ensured that the iron used is of the best quality obtainable. The iron losses have been reduced by skilful proportioning of the core, and the efficiency has been greatly increased, while decrease of efficiency due to ageing is practically eliminated.

The high conductivity copper coils are wound on circular formers with wire of rectangular section and rounded corners, which has been dried before winding. The coils are sub-divided, so that the potential difference across the ends of each coil is very low. The increased amount of copper necessitated by the circular shape of coil is more than compensated by the absence of more or

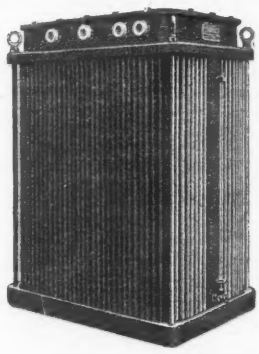


Fig. 15.—Ferranti Transformer.

less sharp bends in the wire, and the result is immunity from breakdown. Each coil is lightly taped, thoroughly dried and impregnated with a special varnish by a vacuum and pressure process, which forces the varnish into every interstice of the coils. Thick insulation of the coils has been discarded, partly because it prevented the penetration of the varnish, and partly because it has been possible to effect a very great improvement by the use of specially-moulded insulating tubes between the primary and secondary windings. The tubes safely withstand the maximum test pressures. The older and more usual method of applying insulation to the coils is defective, because bending the insulating material round the coils does not improve its insulating properties, and breakdown is very likely to occur. The varnish has been subjected to prolonged test in contact with oil at the highest temperature obtained in transformer work, and it has been proved that there is no reaction between the oil and the varnish. The end turns of the high-tension coils are heavily insulated to withstand the high voltage differences which occur during surges when switching on and during periods of atmospheric disturbance.

All but the cheaper and smaller transformers are fitted with heavy terminals mounted on long porcelain insulators mechanically clamped in a substantial iron frame and so arranged that a damaged insulator may be readily replaced. The incoming and outgoing cables pass through heavy insulators in the sides of the tank.

An oil has been found which complies satisfactorily with all the essential requirements of transformer work, and is now used

exclusively in this apparatus. A very liberal quantity of oil is used, and there is an ample head of oil over the transformer.

The construction of the tanks has undergone many developments in the effort to obtain a strong light oil-tight enclosure with ample radiating surface. The construction now adopted as standard consists of a steel tank with deep corrugations, fitted with a steel bottom plate welded to the sides, rendering oil leakage impossible. The tank is supported in a cast-iron cradle; a grooved top casting is placed over the tank and the corrugations enter the groove. The two castings are tied together with tie bolts. The apertures in the top casting giving access to the terminals are closed by substantial boiler-plate lids. The tank is dust-tight, but may be hermetically closed by running white metal into the groove in the top casting. The transformer stands on heavy channel irons and bearers which distribute the weight over the cast-iron cradle.

ELECTRICITY SUPPLY IN DOVER.

The importance of the historic town of Dover—probably the most popular of our gateways to the Continent—has been enormously increased during the past few years by the completion of the vast harbour works, enclosing an area of about 1 sq. mile, and forming a most valuable and commanding naval base. The population of Dover is small (47,000), and though there is a considerable "floating" population of travellers and (during the summer) visitors, it is to the tramways and the Admiralty works in the neighbourhood that the central station must look for its greatest increase in output.

There is every prospect of high-pressure overhead supply being afforded to St. Margaret's Bay* (4·5 miles from Dover) in the near future, and it is quite reasonable to anticipate a considerable colliery load and, later, other important power demands growing up with the development of the Kentish coal fields.

The station is fortunate in being situated at practically the centre of the present supply area—a T-shaped district of about 3 sq. miles extent, stretching along the shore and inland along a valley.

The works, which are finished internally very handsomely, even extravagantly according to modern standards, are built on natural flint foundations, and are flanked by a creeper-clad brick smoke stack 120 ft. in height.

Supply was commenced in April, 1895, by the Dover Electric Supply Co., Ltd., the station being one of the famous early Brush installations, and in 1904 the undertaking was purchased by the Corporation. The original equipment of four Brush-Mordey generators (two of 100 KW., one of 75 KW. and one of 50 KW., later removed) was extended by two 100-KW. McIntosh-Seymour sets in 1897, a 225-KW. Ball & Wood set in 1901, a 400-KW. Ferranti set in 1903, a 400-KW. Parsons turbo-set in 1905, and a 350-KW. Allen set in 1906. The American horizontal low-speed sets were installed at a time when this type was thought to be the best available for traction supply, and when English manufacturers were so filled with orders that numbers of purchasers had perforce to buy from American firms.

In 1908, a 25-KW. Entz reversible booster was installed, and has since brought about important reductions in the generating costs.

Further extension of the building is impracticable on the present site, but the generator capacity will be increased when necessary by the substitution of turbo-machinery for some of the older units.

Boilers of a total evaporative capacity of 42,000 lb. per hour are at present installed; of these, two are rarely used and a third is generally laid-by for cleaning. Water supply is drawn from the River Dour for both circulating and feed purposes (20 per cent. make-up). Of the 21° total hardness, about 15° is temporary and no softening treatment is adopted, it being found that the use of turbine tube cleaners once in 2,000 working hours occupies little more time than the removal of such mud as would collect from a treated feed. The condenser discharge is passed through a wood-wool oil eliminator before returning to the hot well, and an economiser heats the feed water from 90° F. to 310° F. A Krel CO_2 recorder is installed, but it has been found that the normal working results obtained here permit of little improvement by its use.

In the early days of working, large Welsh coal was employed. Crossthwaite grates were installed in 1905 to allow of the use of small Welsh coal, which then cost 6s. per ton less than the larger grade. The costs of the two qualities gradually became more nearly equal, and chain grates were fitted to two boilers in 1908, and to two others in December, 1910, and February, 1911, since when Featherstone slack has been burnt smokelessly under the ½-in. natural draught provided by the stack. It is worth noting that to the contract price of sea or rail-borne coal must be added (per ton) 1s. 7d. town dues and 1s. for carting and trimming; sea-borne coal is also subject to 2½d. per ton harbour dues and 2d. per ton extra for carting. Owing to the high railway freights, sea-borne coal is the cheaper. A good but friable coal from the neighbouring Shakespeare pit of the Kent colliery costs about 22s. per ton at the pit mouth. Accommodation is provided in a covered yard for 550 to 600 tons of fuel (roughly seven weeks' supply).

Some years ago it was possible to obtain 9d. or 10d. per load for ashes, but these have now to be given free, and even a small payment has had to be made for their removal, owing to the recent slack state of the building trade.

The boilers deliver into the upper length of a narrow rectangular ring main erected in a vertical plane entirely within the boiler house and extending 90 ft. along the latter. From the bottom of the ring are taken the engine steam pipes. This arrangement favours heavy condensation losses, and at one time only 35° out of 100° F. superheat at the

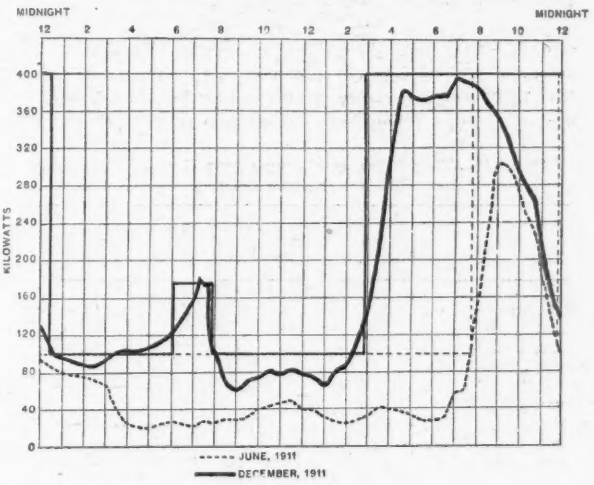


Fig. 1.

boilers could be realised at the turbine stop valve, and an even less amount at some of the engines connected near the centre of the lower half of the ring. Owing to a careful overhaul of the pipe lagging (which now consists of 2¼ in. magnesia composition), at least 55° superheat can now be obtained at the turbine.

As a combined result of the use of chain grates and improved pipe lagging, and thanks to the economy effected by the Entz reversible booster, the fuel costs per unit sold have been greatly reduced during recent years (see Table I), and despite the increase in the repairs and maintenance charges, the total works costs have decreased to the present reasonable figure of 1·62d. per unit. The coal consumption during the days in which the load curves of fig. 1 were obtained averaged 6·04 lb. per unit generated on June 17th, 1911 (3,152 units generated), and 4·60 lb. per unit generated on December 22nd, 1911 (6,269 units generated).

Owing to the very heterogeneous nature of the generating units, it is interesting to examine in some detail the manner in which they are used and the results which are obtained. The oldest units are the Mordey alternators, which have been in regular service since 1895, and which still give good results. Occasionally a new alternator coil is required, but beyond this, their repair bill is extremely low (Table I).

*The load at present available is about 20 KW. lighting, together with a considerable heating and cooking load, there being no gas supply, and the resort being frequented by a good class of visitor.

One of the 200-kw. lighting sets runs on a central condenser and is used whenever possible in preference to the other small sets, which have self-contained condensers and auxiliaries. On account of its higher efficiency (see Table II), the turbine unit is used on the evening a.c. demand five nights in each week, the Ferranti set being kept in order by running on the remaining two evenings. The whole of the steam-driven plant runs condensing (even down to the 12½-kw. exciters, the two sets of which are used in alternate weeks).

TABLE I—Costs per Unit Sold.

Year ending March 31st.	Fuel. d.	Repairs.* d.	Total works costs. d.
1913	·69	·41	1·76
1912	·55	·41	1·62
1911	·61	·44	1·79
1909	·73	·40	1·89
1907	·72	·28	1·64
1905 (15 months) ...	·89	·30	1·89

* Recent increase in repairs costs is due to the L.G.B. requirement that the wages of all permanent employés be paid from revenue.

The d.c. traction load is supplied by one of the 100-kw. McIntosh-Seymour sets during the early morning and evening, and the 225-kw. Ball & Wood, or 350-kw. Allen set is used during the afternoon. A 268-cell Tudor battery floats on the d.c. mains and supplies the whole direct-current demand from 12 mid. to 5 a.m. (fig. 2). The battery discharge capacity is 400 amperes momentarily, and the maximum charging current is 200 amperes. The cells were installed in December, 1898, with a guaranteed capacity of 560 ampere-hours at 10 hours; after they had been maintained for 10 years by the makers (on a contract basis), a further 10 years' maintenance contract was entered upon in December, 1908, and a capacity of 360 ampere-hours at 3 hours is still obtained. When flue cleaning is in progress on Sunday morning or during other light-load periods the battery supplies the power demand, and, through a 30-kw. motor-generator, such a.c. demand as may exist.

TABLE II.—Test Data on Generating Units (Dry Steam at 150 lb. per sq. in.).

Set.	Lighting or traction.	Lb. steam per kw.-hour at ½ load. Actl.	½ load. Guar.	1/1 load. Actl.	1/1 load. Guar.	6/5 load. Actl.	6/5 load. Guar.	Year of instln.
75-kw. Brush ...	L	—	—	34·6	32·5	33·4	—	1895
100-kw. Brush ...	L	—	—	31·2	30·8	32·0	—	1895
400-kw. Ferranti ...	L	—	29·5	25·0	25·0	—	—	1903
400-kw. Parsons Turbo*	L	26·47	25·25	23·79	22·25	—	—	1905
100-kw. McIntosh-Seymour	T	—	—	30·0	—	—	—	1897
225-kw. Ball & Wood	T	—	—	27·0	—	—	—	1901
350-kw. Allen ...	T	28·75	29·5	26·0	25·3	—	—	1907

*This set occupies 118 sq. ft. and 650 cb. ft., as compared with 255 sq. ft. and 3,750 cb. ft. occupied by the Ferranti set of equal capacity.

Owing to the arrangement of the steam piping, and the early design of the greater part of the equipment, high steam efficiency cannot be expected, and the actual performance of the various sets, as summarised in Table II, is by no means unsatisfactory.

(*To be concluded.*)

A Jubilee Outing.—To celebrate the jubilee of the firm, Messrs. Baxendale & Co., Ltd., of Miller Street, Manchester, entertained their employés to an outing to Chester last Saturday. Five special trains were needed to convey the 1,600 employés and their wives and friends. At Chester a number of steamers were waiting, and the river journey to Eccleston Ferry was enjoyed. By permission of the Duke of Westminster, the party were able to go through the grounds and gardens at Eaton Hall. The return to Chester was by char-a-banc. Luncheon was served at the Roodee. During the afternoon there were sports, a football match, and an *al fresco* concert, and the band of the Old Cheshire Military played selections throughout the day. Mr. Charles Darrah, senior partner, presented a gold watch to each of five employés who had completed over 40 years' service with the firm.

THE FIVE-DAY WEEK.

[communicated.]

A few years ago the industrial world was startled by the cry for an eight-hour day. It was fondly imagined that the claim to work for only eight hours in the 24 was voiced only by the agitator, and that to grant it was wholly without the domain of practical politics. *Sed tempora mutantur!* The dream of a few years ago has become a reality! In one great industry at least the eight-hour day is hallowed and sanctioned by Act of Parliament. The same division of time in every department of industrial activity is still insistent, while the colliers who claimed, and won, their eight-hour day, are now putting forward a demand for a five-day week.

It is only a few weeks ago that the leaders of the Miners' Federation set about balloting the members of that body on the question of enforcing a five-day week. A simple sum in arithmetic shows that this proposal would result in the miners working for a period considerably less than two *whole* days and nights in seven. The agitators urged their followers to support this extraordinary claim. As luck would have it, many of the men did not see eye to eye with those who pull the strings of the Federation. The proposal was carried by a small majority; but it was fortunately so small that it was decided not to take any immediate action. Bitter experience, however, has taught us that what is looked upon as a mere topic for agitation in one year is likely to take practical shape in the next.

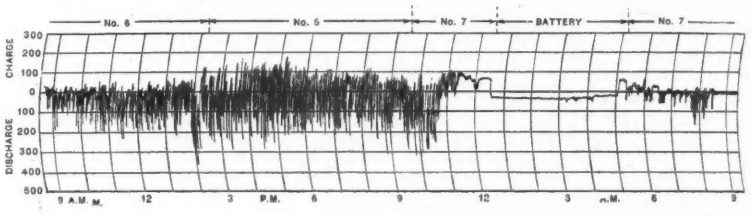


Fig. 2.

What is the cause of the slackening of the national fibre which is manifested by this claim for more leisure and less work? One knows that the miner's life is a life of arduous toil, and that in some districts, at any rate, he runs grave risks. But, on the other hand, one knows that he is well paid; and that he is generally a man of great physical strength who can earn in four days (or even three) enough to support himself and his family during an entire week. Why, then, need he concern himself with any demand for a five-day week?

A glance at the hard facts of the case shows that the miner is well paid for the labour he expends. If the average pithead value of coal is 8s. 4d., that sum is made up as follows: Labour, 6s.; expenses and maintenance, machinery, &c., 2s.; capital, 6d. Yet there are those who believe in an agitation which has for its object the nationalisation of mines on the ground that the miner is the victim of the bloated capitalist. If all the working classes in the country were in as flourishing a condition as the miners there would be little true ground for complaint.

Is there a real genuine desire in the mind of any pitman that he shall only be entitled to work on five days in the week? If there is, we can only explain his state of mind by assuming that he is in ignorance of the true facts. So long as the demand for coal is large, the miner can earn enough for his requirements in a short time. The state of affairs when the demand for coal is small and the prices go down is not revealed to him by those who urge him to political action from the tub at the street corner. He will then have to work much more than 40 hours a week in order to produce enough coal to keep body and soul together.

The brains of those who direct the policy of the proletariat are perpetually devising new campaigns in the prolonged war against Capital. They are not content with one victory, they must seek fresh conquests. In truth and in fact they live and maintain their popularity and reputation by conquest.

Your labour leader is always seeking some fresh battlefield

in his war against Capital, but he is doing nothing to consolidate and render perpetual the victories he has already secured. He relies upon the ignorance of his followers. So long as the proletariat can live upon the spoils of war—the increased wages wrested from Capital—so long, we doubt not, will they give support to their misguided leaders. But they will learn in time, and by bitter experience, that the country, as a whole, is not made richer if Capital is impoverished and destroyed at the expense of labour.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Conservation and Waste.

Mr. D. S. Martin would be more convincing if less intolerant. He is so thoroughly imbued with the superiority of the central station idea that he justifies the setting of rates to kill the isolated plant—the words are his own. Surely if the central station were so superior as he endeavours to make out the "setting of rates to kill" would be a superfluity. The mere fact that it is necessary to *set* a rate is evidence that the ordinary rate is one on which the isolated plant can live. And I learn from New York that the central station men are all of his type and are out to kill. But I do not learn that, having succeeded in their attempts, they retain the killing price when the isolated plant has been broken up. Mr. Martin has but one idea of motive power. With him there is only steam to be considered—an attitude of mind with which one can be extremely sympathetic, for steam plant is far nicer than gas plant. But its niceness is not a quality that will stop the spread of gas plant; and modern engineers must inevitably face the future of power manufacture free from shackles which will hold them to any pet motive power. If gas were as general a fuel as steam now is, there would be a tendency to the spread of smaller power stations. The existence of a gas power station to every group of even 1,000 people can be shown to be capable of co-operative production of heat, light and power, far beyond anything that it is in Mr. Martin's power to derive from the big station scheme. The true economy to be derived from co-operation is in the generation of all the requisites of the people's life within a heat transporting possibility of distance from the homes served. Gas is the thing to be sent round from a central generating station, where also it would be used to generate power for large factories and for such public utilities as tramways.

The finish of Mr. Martin's article deals with the hydro-electric industry, which cannot properly be used by him as an argument for great central fuel-driven stations. Water turbines have an efficiency of 80 per cent. of the water used, and 75 per cent. of its energy of fall may be converted into electrical energy. Some would state even a higher figure. This may be compared with the miserable fraction of the calorific power of coal which appears as electrical energy in the very biggest of coal-driven stations.

From hydro-electric energy, heat may be derived with advantage for heating purposes and for metallurgy, but to use electrical energy, which has been steam generated, as a heating agent is outside the range of economical practice where the heat is allowed and required to flow freely. Cooking—so dear to the power-station man—is an illustration of the possibility of using such heat with economy. But regular house warming is out of the practicable range.

Much of Mr. Martin's article—notably, the third paragraph—is, by way of argument, against himself. With him it is not a case of "live and let live," but of "you promptly die that I may gnaw your bones."

As conditions now are, especially in America, there is a very strong case for the independent station. In the first place, its suitability to live is to be measured by a set of rules quite different from what properly hold good at the big power stations. In the big power station, the labour cost may be small per unit, but every hour of paid labour must count. In the private station no labour can be counted against the cost of energy if that labour would be employed, whether the private plant worked or stopped. The private owner of a plant must count the cost of heat, light and power. If he must have heat, it may cost him very little to take power energy out of the steam *en route*. He cannot buy his heat from the big power station miles distant. In America, as here, central station men are working upon very narrow lines; they take no broad views of facts, and can see costs only from the ledger. Central station men, we are told, are acting from their convictions. But plenty of people do this—burglars not excepted—but conviction is not of necessity a proof of right. It may be a case of bad judgment, after the manner of the bull which charged the locomotive, arousing admiration for his pluck, though his judgment was to be despised.

Absolute ignorance of everything appears to be the characteristic of Mr. Martin's slaughtered friend, who has ventured to criticise the central station craze—if it may be permitted to call the idea by that name. But let Mr. Martin be assured that all America is by no means enamoured of the central station.

Especially in the big cities, the isolated plant is not small, and is capable of being managed on a good principle. Our nearest comparison here is probably the cotton factory, and it has yet to be shown that an electrically-driven cotton mill cannot better produce its power and heat and light by means of its own power plant than such can be produced by the supply station. Advocates of the power station ignore that such things as heat are needed, or they attempt to include heating a factory in the same category as the cooking of a chop or the toasting of a bit of bread. Surely it ought to be too late at this hour to claim quantitative electric heating as a suitable field for expending energy.

B.

A Question of Etiquette.

It afforded me great pleasure to peruse Mr. A. W. Kimber's interesting letter in this week's REVIEW; it is a subject in which I am keenly interested, and nothing would be better for the trade generally than some sterner supervision, such as is advocated by Mr. Kimber. I, of course, cordially agree with his statement that all supply authorities are not tarred with the same brush; in fact, the most successful station I know is Sheffield, where they had, until recently, a wiring department which did first-class work at a reasonable price, and I do not doubt that the said wiring and sales departments have been mainly responsible for the successful development of the electrical industry in Sheffield.

On the other hand, I know another supply station that does all the installation work in a certain borough and most of the country house work in the surrounding districts; just under £800 net profit was made from installation work during the year prior to my going there.

The extremely energetic chief told me that he had never had any opposition, and did not intend to have any, and I must say he did his very best to prevent anyone else even trying to get any work.

When I asked the above-mentioned chief why he did not earth the motors he supplied and fixed, and protect wires and cables which he installed in hollow partitions, he replied that anyone cleaning the commutator of an earthed machine was very liable to get a shock across the wrist to frame, whilst if the frame was only partly earthed the shock would not be severe; he also said that there could not possibly be any hurt done to any wires or cables installed in such a small space as there is in a lath and plaster partition—it made me stare pretty much. I have come across several firms and companies that do bad work, and I often wonder who is supposed to see that the B. of T. regulations are adhered to, and whether any insurance companies employ an electrical inspector of any kind. I can't think that the work in that particular place

E

has been inspected by anyone, unless it is the engineer himself.

I am taking Mr. Kimber's advice of this week, writing the Board of Trade and about a dozen insurance companies, and trust something will soon be done to put a stop to some of the awful work that I know is being done.

J. Riley.

Inverness, *August 24th*, 1913.

Mr. Kimber is, I expect, only one amongst many who were astonished to read the results of the recent arbitration case. The case is particularly piquant, bearing in mind the undertaking concerned.

There is no doubt that when a supply authority itself carries out wiring work it should resolutely set its face against doing any but first-class work, otherwise its position in dealing with contractors must be most invidious.

The company with which I am connected has for many years conducted a very considerable wiring business, but we have always made it our first principle that on no account will we carry out any but first-class work. This, of course, means that we lose a considerable amount of business which would otherwise pass through our hands, as we are constantly being undercut by contractors, who use non-association wiring and cheap accessories. We prefer, however, to lose the work rather than lower the standard we have set up.

If a consumer comes to us and wants us to carry out work at a price which will not allow of the use of first-class material, we tell him openly that while we will not carry out the work ourselves, he will find plenty of contractors who will be pleased to do it. Of course a supply authority has no power to refuse to connect up work simply because it does not comply with its rules or those of the I.E.E. The position we take up is simply this: We have a standard of work to which we adhere ourselves, and which we recommend consumers to insist on for their own sakes. If they choose to have inferior work installed, it is entirely a matter for themselves, and they must take the risk of it. They will be doing it at any rate with their eyes open.

Personally, I think it is a mistake for a supply authority to set up the I.E.E. or other rules as hard and fast conditions which must be adhered to. There is any amount of quite good wiring done which does not comply with the I.E.E. Rules, and I would be the last to refuse to connect it. The I.E.E. Rules should be considered as a model specification which all contractors should aim at and comply with as far as circumstances and the customer's pocket permit.

In expressing these views, however, I am afraid I shall be considered most heretical.

M. Farrer.

Twickenham, *August 22nd*, 1913.

Lightning.

Mr. Austin's contribution on the "Vagaries of Lightning," though of interest, unfortunately fails to give some rather important details which are necessary to explain the observed effects during that lightning storm. It is essential to know on what voltage the two lines were operated, and what was the voltage for which the horn arresters were set. It frequently happens that arcing over is not so much due to elevated potential as to an unfavourable distribution of the potential, and this particularly happens when such arcing over is observed whilst lightning takes place between clouds and earth (as in the present case), and not between cloud and line, or the system itself. In such cases the effects are due to induction, and everything can be explained without having recourse to assuming "terrestrial disturbances." I presume that the lightning arresters which showed no sign of operation were set at considerably above the line voltage, and in this case it is quite feasible that a disturbance on the line caused by the inductive effect of a distant lightning discharge might have had a potential considerably below that for which the horn arresters were set, and therefore they could not operate.

As Mr. Austin himself remarks, the use of a condenser would, in all probability, have been sufficient to level out the abnormal potential distribution which I mentioned above, and thus would have prevented the damage. The idea that atmospheric disturbances must of necessity be of an extremely high potential is too commonly assumed: in practice it is far more frequently the abnormalities produced by such inductive discharges in the potential distribution which break down the insulation and this in turn introduces surges which may be of very high potential.

A. W. Isenthal.

Neasden, *August 22nd*, 1913.

Shift Engineers: A Proposal.

I do not see why women should not study engineering as they study medicine or the law. M.I.E.E. is no harder to get than M.D. or LL.B. The suggestion that women are irrational or hysterical does not seem to carry much weight. Mr. Brown's suggestion, that baboons would do as well as women, seems to indicate a mind so warped by prejudice as to be incapable of rational thinking. His judgment on any subject on which he had any prejudices or feelings would be liable to be biased, and so worthless. Science has no feelings and emotions. "Shift Engineer" seems to think that typewriting, clerical work and window smashing are all that women are suitable for—prejudice again—at least, I hope it is prejudice; one hesitates to accuse one's kind of invincible ignorance. In fact, all the letters in this week's ELECTRICAL REVIEW show prejudice, emotion, and even hysteria (the baboon suggestion is obviously hysterical), and suggest that these are a poor mental equipment to bring to the solution of any problem. Whether women could study and make themselves efficient engineers is arguable, but not in the nursery.

Engineer.

Judging by the views expressed by the correspondents on this subject, it would appear that either they have been rather unfortunate in their acquaintance with women—not only as workers, but in general—or else they are selecting specific types of women, and amusing themselves by supposing what would happen if they were employed in central stations. This method of argument is neither logical nor just; undoubtedly there are many women quite unfitted for central-station work or anything like it, but are there not many men of whom the same might be said?

That central station work is at the present time unsuitable for women, most people will agree, but capability is another question altogether; women are more adaptable than men as a whole, and given equal opportunities—well, time will prove. Already witness what has been done, and is being done, in various parts of the world by women; one example: Madame Curie, apropos electrical science.

J. Halliday Borland.

High Wycombe.

"A Mere Woman" promises in to-day's issue what she cannot guarantee. The well-educated women who are positively afraid of an electric radiator generally have the good sense to stay away from it. I could introduce you to a gentleman who holds a position of responsibility in a city bank, who left his own house while I was visiting it because I, at his wife's request, ventured to replace a melted fuse to supply current to the drawing room. After the fuse had served its purpose for 15 minutes, he was induced again to occupy his armchair in the drawing room.

Similarly, a shift engineer in charge under me visibly shivered in his trousers when a fuse became white hot, and "wished he had" my nerve when I maintained the supply by wrapping some wire around the terminals. He went to a more suitable appointment in the fish market, and is there a success.

Women are handling switching operations in telephone work, and there is no reason why properly-trained women

should not do central station switching work, and I give them credit for knowing how to keep men in their places, if they neglect their work, as suggested by "A Mere Woman."

The only reason why women in the past have let men keep them out of the many occupations is that men had the control of the education of the daughters, and the daughters were trained for home work only. So long as there are unmarried women who need to earn their living and who have the energy and courage to train themselves, there is no reason why they should not compete with men in every occupation. Capacity and training are the limits.

I think, for instance, that the average woman, trained to electric work, would do better than the men who wired the house of the City banker, mentioned above, using no tube, no casing, but simply dropping wires between rafters in a most irregular way. Several years of use has done no damage, and the banker keeps cats to keep away rats. Who is responsible for calling the Insurance Co.'s attention to the way men did that work?

A Man who Believes Woman his Equal.

London, *August 22nd*, 1913.

[We have received from Mr. Cooper, on his return from holidays, a further letter on the prevention of accidents in electric lifts, in reply to Messrs. Smith, Major & Stevens; but as no new points are raised, we do not think it necessary to reopen this correspondence.—Eds. Elec. Rev.]

BUSINESS NOTES.

Consular Notes.—Palestine.—The German Consul at Beirut reports that with the extension of the use of electricity for lighting purposes and the growth of industrial activity in the towns of Beirut and Damascus, a growing demand for electrical materials has sprung up. Transmission wire, which is imported in diameters of from ¼ to 4 mm., comes from Germany and France. Incandescent lamps, of from 16 to 200 c.p., for 105 or 110 volts, are imported from Germany, Great Britain and France. Electric fans, which find an increasing demand owing to the heat of the summer, come chiefly from Italy, which supplies a cheap article. In Beirut, ventilators for 110 volts, with a wing diameter of from 25 to 40 cm., are used. Table ventilators cost from 25 to 70 marks at the works, and ceiling ventilators from 100 to 150 marks.

Philippine Islands.—The British Consul at Manila reports that a system of wireless telegraphy composed of stations at various points connecting all the more important places in the Archipelago, is now working under the direction of the Bureau of Posts. The stations already in operation are at Jolo, Zamboanga, Davao, Malabang, Cuyo and Puerto Princesa. The Bureau is also installing one at Mangarin, Mindoro. The army wireless stations are at Fort Wint on Grande Island, at Fort Mills, at Corregidor, and at the Government ice plant at Manila. The two inter-island transports are also fitted with the apparatus, and keep in touch with one land station or another during the whole of their voyages round the islands. The most powerful station is that at Corregidor, which has a range of 1,000 to 1,500 miles, according to weather conditions. Those of least range are on the inter-island transports *Warren* and *Merritt*, which do not require a message radius of over 400 or 500 miles.

Brazil.—The American Consul at Bahia, in a recent report, states that a telephone system, American throughout in equipment, and providing a service equal to that of any city in the United States, has recently been installed in Bahia, and is giving complete satisfaction to subscribers. The new service was inaugurated in 1912, under a concession held by Guinle & Co., one of the largest public utility and holding companies in Brazil, who administer the local telephones under the name Companhia Brasileira de Energia Electrica. The telephone concession for the city of Bahia was orginally granted to the Empresa Telephonica in 1884 for a period of 50 years. Six years ago Guinle & Co. bought out the Empresa Telephonica, paying about £27,000, and for a time operated the service along the old lines and with the inadequate equipment then on hand. The instruments at that time were of American make, and of the kind in use in the United States about 25 years ago. The system, aside from the American instruments, was German throughout. Under the terms of the Guinle concession, it was provided that a thoroughly modern service, representative of the latest improvements in telephone devices, should be installed and in actual operation by July, 1912. American experts in telephone construction were secured, and a complete outfit of modern devices for central-exchange use and materials for outside construction work was purchased from the United States. The result is that to-day Bahia possesses a telephone system comprising the latest accepted type of instruments and other apparatus such as are now in use in the larger American cities. The instruments in use and most of the other equipment are of the type manufactured by the Western Electric Co. The switchboard in the local exchange is made by the Kellogg Co. There is only one exchange at present, but two others are to be opened within the year to care for outlying sections of the city. The old company operated about 500 telephones; the new service already has 860 subscribers, and it is planned to extend and improve the service until 2,000 telephones are installed in the city and immediate suburbs. At present the lines extend about 6 miles to the outskirts of the city. There is no long-distance service. Important work is under way to place all wires, now overhead on poles, in concrete conduits underground. The outlay to date for changing the old outfit for the new has been over £125,000, and when the service is perfected (within the next 12 months) the total cost will approximate £200,000. The annual subscription for the present service has just been fixed at £12 for business houses, and £11 12s. 6d. for residences.

France.—The British Consul at Havre reports that the Chamber of Commerce there has decided to establish a wireless telegraph station in their Magasin de Sauvetage for the reception of the time signals sent by the Eiffel Tower station. Navigators will thus find in the port the exact time. The Chamber is waiting the authorisation of the Administration of Posts and Telegraphs to commence the construction of the necessary installations.

Italy.—A German official report states that there is a great future in Italy for electrical cooking, &c., apparatus for household use, as electric current is available not only in the large towns, but also in many small villages, owing to the extended service from the overland power stations. These goods are already being imported from Germany, and their production in Italy in small quantities has been started. The classes chiefly in demand are electrically-heated irons, cooking stoves, food warmers, table utensils, such as kettles, coffee urns, heating plates, toasters, &c., nickelled or silvered, also cooking utensils, such as kettles, stoves, pans, &c., of brass, nickelled or of iron, enamelled inside.

United States.—The British Consul at St. Louis reports on the large hydro-electric plant on the Mississippi at Keokuk, about 200 miles from St. Louis, which city will be supplied by overhead wires. The company obtained a perpetual licence and were required to build a lock and dry dock to be the property of the United States Government. The dam will hold up the river and deepen the channel for 65 miles. This new electric supply will not reduce the price to householders, as it requires special equipment to change the high-tension current at 13,200 volts, which will necessitate a complete equipment of transformers, lightning arresters and special switches. Factory owners and other users will each have to install the necessary apparatus. The rates to be charged are either by the kilowatt demand, the average amount of current the customer's equipment can call for in any consecutive 15 minutes or the actual amount of current used. The present rate per kilowatt demand varies from £7 8s. 5d. for the first 10 KW. to £3 14s. 2d. for over 120 KW. The energy rates per KW.-hour vary from 1¾d. for the first 1,000 hours to ⅜d. for excess of 50,000 hours. The Keokuk dam rates vary from £4 2s. 5d. per year per KW. for a 200-KW. demand to £2 9s. 5d. for a 1,000 or more KW. demand. The smallest amount to be supplied to any customer will be a demand of 150 KW. and 25,000 KW.-hours in a month, but it is stated that the cost will be one-half that at present, plus £2 a month, for maintaining switches, &c.

Norway.—The American Consul at Christiania reports that the manufacture of electrical machinery and apparatus, which was unknown in Norway only a few years ago, is now increasing very rapidly, not only in extent of output but also in variety of goods manufactured. Germany formerly sent nearly all such goods used to Norway, and still supplies a large part, but home manufacturers have decreased the amount imported very materially and each year furnish a larger part of the demand. Telephones have been exported in large quantities for many years, and the factory where they are made has been forced to enlarge its plant several times.

Book Notices.—"The Water Works Directory and Statistics, 1913." London: Hazell, Watson & Viney, Ltd. Price 10s. 6d. net.

"Oil." By W. Antrobus. Manchester: From the Author. Price 3s. 6d. post paid.

"Leeds Chamber of Commerce Year-Book." 1913. Derby: Bemrose & Son, Ltd.

"Underwriters' Requirements." By D. Pierce. 1913. London: Crosby Lockwood & Sons. Price 4s. 6d. net.

"Calendar of the Royal Technical College, 1913-14." Glasgow: The College.

"Prospectus of the South-Western Polytechnic Institute, 1913-14." London: The Institute. Price 1d.

"*Proceedings* of the Physical Society of London." Vol. XXV, Part V. August 15th, 1913. London: *Electrician* Printing and Publishing Co. Price 4s. net.

"*Journal* of the Western Society of Engineers." Vol. XVIII, No. 6. June, 1913. Chicago: The Society. Price 50 cents.

"*Journal* of the American Institute of Architects." Vol. I, No. 7. June, 1913. Harrisburg, Pa.: The Institute. Price 20 cents.

"*Bulletin* Mensuel of the Société Belge d'Electriciens." Vol. XXX. July, 1913. Brussels: E. Bruylant. Price 1 fr. 75.

"*Bulletin* de la Société Internationale des Electriciens." Vol. III, No. 27, July, 1913. Paris: Gauthier-Villars.

"*Boletin* de Ingenieros." Vol. III, No. 11. July 16th, 1913. Mexico: Secretaria de Guerra y Marina.

The June issue of the *Telefunken Zeitung* celebrates the tenth birthday of the Telefunken-Gesellschaft with a review of the history and achievements of the company, and gives a map of the world, showing the long-distance schemes projected by the leading nations; these include seven crossings of the Atlantic, four of the Indian Ocean, and three of the Pacific. A diagram shows the rapid progress of the company's business since the adoption of the singing-spark system in 1909. Nearly 2,000 stations had been supplied on the Telefunken system up to last month. Successful communication in July between Sayville, U.S.A., and Nauen, a distance of 6,400 km., is put on record, a Telefunken high-frequency machine of 6 KW. being employed.

Patent for Disposal.—A patent for improvements in electric induction furnaces is open for licence. See our advertisement pages.

Germany.—The Westerwald Electricitätswerk Gesellschaft is the name of a new company which has just been formed at Höhr, with a capital of £140,000, to establish a large electricity supply station. The Gesellschaft für Elektrische Unternehmungen, of Berlin, is interested in the new concern.

Bankruptcy Proceedings.—JACK FRANCIS BARNES, electrical and mechanical engineer, picture house proprietor, &c., Oldbury, Worcester, and Cradley Heath, Stafford.—The first meeting of creditors herein was held on August 20th, at Ruskin Chambers, Corporation Street, Birmingham. The statement of affairs disclosed liabilities totalling £465 and assets estimated to produce £40 odd. It transpired that the debtor about 19 years ago started cinematograph exhibiting at Blackpool and had continued this in nearly every city and large town in the country. Fourteen years ago he settled in London and worked his business from there, removing to Smethwick six years ago. He had also been owner or part owner of the picture houses at Cradley Heath, Bromsgrove, Halesowen and Oldbury since 1909, but at the present time he only had a half share in the lease of a picture palace at Spinner's End, Cradley Heath, estimated to be worth £25. No books of account had been kept, only letter books being forthcoming. The Official Receiver remains trustee.

JAMES EDWIN STOTT, electrician, Huddersfield.—Notice is given in the *London Gazette* that the bankrupt's discharge is suspended for three years.

Restoration of Patent.—An order has been made restoring patent No. 3,300 of 1907 granted to Maurice Goudard for "Improvements in and relating to radiators for the cooling systems of explosion systems."

Lamp Works in Spain.—La Sociedad Wolfram, Fabricade Lampara Electricas is the name of a new company which has just been formed in Barcelona with a capital of £8,400, to manufacture metal-filament lamps for the Spanish market.

Catalogues and Lists.—MESSRS. SCHAFFER & BUDENBERG, LTD., Whitworth Street, Manchester.—Section 5, catalogue (44 pages) containing fully illustrated information respecting their iron, steel and gun-metal valves; prices are indicated. Section 22 is a leaflet showing their patent "Concentra" oil pump, and No. 29 deals with "Jena" water-gauge glasses and gauge glass protectors.

MESSRS. FERRANTI, LTD., Hollinwood.—Illustrated price list fully describing their electric cookers.

MESSRS. BONECOURT SURFACE COMBUSTION, LTD., Parliament Mansions, Victoria Street, London, S.W.—Four-page illustrated leaflet relating to the application of Bonecourt heating diaphragms to industrial purposes. Prices of standard sizes are given.

MESSRS. A. REYROLLE & CO., LTD., Hebburn-on-Tyne.—Two new illustrated lists; No. 190 relates to and shows their three-phase 600-volt draw-out type ironclad switchgear; and No. 52 is an account of the Merz-Price system of automatic protection for high-tension circuits, including a reprint of our own article of 1908 on the subject. We referred to this subject also in our June 20th issue, page 1043.

THE BRITISH THOMSON-HOUSTON CO., LTD., Mazda House, 77, Upper Thames Street, E.C.—Booklet on "Industrial Lighting," containing 28 pages of well illustrated descriptive matter relating to the scientific illumination of textile mills, engineering works, warehouses, &c. The contents are of an exceedingly interesting character, and include data and curves which will appeal to those who are taking up the question of industrial illumination.

THE BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD., Manchester.—Pamphlet, being one of the "envelope series" entitled "Why Waste Watts?" describing and illustrating the Westinghouse portable watt-hour meters.

WESTINGHOUSE COOPER-HEWITT CO., LTD., 80, York Road, King's Cross, London, N.—Two reprints; one relating to the progress of the mercury vapour converter, and the other to "Mercury Vapour Converters," by Maurice Leblanc, Jun.

WALTHAM MANUFACTURING CO., 2, Jackson Road, Holloway, London, N.—Illustrated price leaflet respecting Waltham arc lamps of flame, enclosed, lantern, printing and studio types.

MESSRS. SIEBE, GORMAN & CO., LTD., Neptune Works, S.E.—Catalogue E, relating to air compressors and vacuum pumps, and desiccating apparatus; also leaflet regarding their "Oxacet" plant for welding and cutting metals by the oxy-acetylene process.

MESSRS. BRUCE PEEBLES & CO., LTD., Edinburgh.—Pamphlet No. 18 B (24 pages), in their standard style and size, giving particulars of large size open-type continuous-current dynamos and motors. Machines of the open type are exclusively dealt with, smaller continuous-current machines forming the subject of another publication; besides giving a full detailed specification and a number of half-tone illustrations, it contains approximate weights and dimensions of the different frame sizes, lists of ratings with technical data, &c.

THE POWER PLANT CO., LTD., West Drayton, Middlesex.—Price List No. 7 of their insulating and reversible flexible couplings, types "L" and "C," of which they make a speciality. Full details of dimensions and prices are given.

THE BRITISH ALUMINIUM CO., LTD., 109, Victoria Street, E.C.—Pamphlet No. 143 just issued, dealing with the use of aluminium in the electric railway world. The pamphlet is illustrated, and covers cables, collector bows, field coils, coach panels, &c.

MESSRS. OZONAIR, LTD., 96, Victoria Street, S.W.—Leaflets describing new portable Ozonair apparatus, type No. 28, for A.C. only, and types 26 and 27 for tropical climates.

Trade Announcements.—THE RECORD ELECTRICAL CO., LTD., of Caxton House, Westminster, wish to notify their Scottish clients and friends that Mr. C. E. Hart, late of Standard Buildings, has joined partnership with Messrs. Edmiston, Brown and Co., of 219, St. Vincent Street, Glasgow. This firm will from now be their accredited agents for the whole of Scotland. Its telephone number is 1189 Central, Glasgow.

The offices of *Gas and Oil Power* have been removed from 3, Oxford Court, Cannon Street, London, E.C., to Weavers' Hall, 22, Basinghall Street, London, E.C., to which address all communications should in future be sent. New telephone number, 4856, London Wall.

It is anncunced that the business of ROBERT BRENARD AND BRENARD & CO., electrical engineers, of 12, Cloth Hall Street, Huddersfield, has been closed.

MR. J. MONTAGUE WOOLNOUGH, who for the last five years represented the General Electric Co., Ltd., has now joined the staff of the British Westinghouse Electric and Manufacturing Co., Ltd., as one of the supply department representatives in the London district.

Dissolutions.—W. T. AKED & CO., motor and electrical engineers and dealers, St. Anne's-on-Sea, Ormskirk and Penrith.—Messrs. F. A. Scholes and W. Aked have dissolved partnership. The business and assets have been sold to W. T. Aked & Co., Ltd., who will attend to debts, &c., and continue the business.

Calcium Carbide in Brazil.—An American Consul states that within a few months there will be in operation at Palmyra a plant manufacturing carbide of calcium under the most advantageous conditions, with abundant water power capable of generating 4,500 H.P. Most of the equipment will be furnished by the Società Italiana Westinghouse, of Vado, Italy.

LIGHTING and POWER NOTES.

Acton.—In his annual report on the finances of the U.D.C., the accountant to the Council says that a settlement has been arrived at of all the outstanding matters in connection with the transfer of the Council's electricity undertaking to the Metropolitan Electric Supply Co., Ltd., and that the final accounts disclose a surplus of £2,696, which has been transferred to the credit of the district fund account. This surplus is additional to the sum of £2,500 paid by the company as part consideration money for the transfer of the undertaking, and credited to the district fund account in the previous year. The Council will, in future, pay the instalments and interest on the electricity loans as they become due, and the amounts so paid will be reimbursed by the company.

Atherton (Lancs.).—Mr. C. T. Astbury, electrical engineer to the U.D.C., has been authorised to negotiate with the tramway company with a view to obtaining an amended agreement with the Council for a supply of electrical energy.

The L.G.B. has sanctioned the borrowing of £6,300 for electricity purposes.

Australia.—The Sydney City Council has agreed to a bonus scheme, proposed by the engineer, with a view to securing decreased fuel consumption at the power house. This provides for a monthly bonus depending on a reduction in the standard rate of coal consumption, which is taken as 2·8 lb. per unit generated. The standard will, of course, vary with the class of fuel used.

The North Sydney electricity scheme is still undecided. The Council has passed a resolution not to proceed with the proposed agreement with the Northern Sydney Electric Light and Power Supply Co. as drafted. Negotiations are still being carried on, and the company has purchased a 300-KW. generating set.

An application has been made by Messrs. Hoadley & Lawton, Moe (V.), for a licence to divert water from Narracan Creek, for a

hydro-electric plant, in the interests of a company which proposes erecting extensive works in a neighbouring town.

Another hydro-electric scheme, according to the *Australian Mining Standard*, has been submitted to the Victorian State Government by Mr. V. J. Crowley, for a plant at Dights Falls, to supply Melbourne, and is being considered by the Public Works Department.

The Camberwell (V.) T.C. has adopted an agreement for five years for street lighting, with the Melbourne Electric Supply Co. at a cost of £900 per annum for 251 lamps; the present gas lighting costs £969 for 212 lamps.

Basingstoke.—New Plant.—The T.C. has authorised the borough engineer to advertise for conditional tenders for Diesel generators, balancer set, booster set, storage batteries, main switchboard, cables and cable laying, and an overhead travelling crane, in connection with the proposed E.L. scheme. A site in Brook Street has been secured for the erection of an electric light station.

Battle (Sussex).—Workhouse Lighting.—The Board of Guardians on August 22nd decided to have the workhouse premises lit by electricity, and to ask Mr. A. E. Ticehurst, of the Bexhill electricity works, to draw up the necessary specifications for the work. At present oil lamps are used.

Bedlington.—Street Lighting.—The Lighting Committee has reported to the Council that the Bebside Coal Co. has arranged to light the streets at Choppington colliery by electricity on similar terms to those which applied to Bedlington colliery.

Belfast.—The Tramways and Electricity Committee has conferred with the Harbour Commissioners in regard to the suggested site for the new power station near Mulgrave Channel. The Commissioners are prepared to grant a 10-acre site, forming part of reclaimed land on the south of the Channel, at a rental, and will fill it up to building level if approved.

Blackpool.—During the past four months the electricity department has recorded an increase of 129,766 units in the output, and 129 new consumers have been added, or 55 more than during the corresponding period of last year.

For the autumn season the Corporation is to expend about £2,000 on electrical illuminations along the whole of the three miles of sea front. No fewer than 60,000 electric lamps will be used.

Brymbo.—Public Lighting.—The P.C. has decided to adopt the Lighting and Watching Act, 1833, which will give it power to undertake public lighting. Electricity, to be supplied by the Brymbo Steel Co., will be utilised, and the scheme provides for 38 lamps at a capital cost of £200, and from 10s. to 12s. per lamp per annum for lighting.

Chartham (Kent).—A proposal is on foot to form a company with the object of supplying electricity in Chartham and district.

Continental Notes.—Norway.—It is reported that the municipality of Trondhjem has recently voted a sum of £43,333 for the erection of a new auxiliary power station. The main portion of the energy from this station will be employed for the heating of houses.

The harnessing of the Sonde Waterfalls, belonging to the A/s Skallenborg has now been completed and the cable to the town of Tönsberg was tested recently, although the ordinary supply will not commence before a few weeks' time.

The town of Horten will also get electric light in the near future, and the energy will be supplied from the same source as soon as the transmission lines are in order.

Germany.—As a result of negotiations between the Nuremberg Schuckert Co. and Brown, Boveri & Co., of Mannheim, on the one hand, and the Government of Bavaria on the other, a concession has been granted to the two former companies to establish electricity works for the supply of electrical energy in the greatest portion of Lower Franconia and the western portion of Upper Franconia. The first instalment of the new works, the erection and equipment of which are expected to occupy a period of three years, is to comprise four units of a total of 30,000 kw., and the service is to be rendered available in 20 towns and about 1,200 communes. The transmission is to be effected at exceptionally high pressure, and the expenditure on the overhead network alone is estimated at £1,000,000, independently of the cost of the generating station and equipment, and sub-stations. It is possible that the station will be worked in conjunction with the Franconia power station and the Palatinate station of the Rhenish Schuckert Co., in Mannheim, which aims at the supply of the whole of the Palatinate. The promoters of the scheme state that the report is incorrect that they have acquired lignite mines at Wustersachsen for the purpose of using brown coal as fuel in the station, no details having yet been decided upon. Apart from the capital which will be raised by the two promoting companies for carrying the scheme into effect, it is mentioned that various local authorities will co-operate in the matter by the grant of loans, but not by the subscription of shares or bonds.

Dewsbury.—Proposed Bonus Scheme.—Reporting upon the past year's working of the electricity department, the electrical engineer, Mr. R. H. Campion, stated that the number of units sold had increased by 274,272, and the receipts from the sale of current for lighting, power and tramways showed an increase of £1,354. The total expenditure, however, increased by £639. The reserve fund stands at £2,596. Mr. Campion advocates the establishment of something in the nature of a bonus or co-partnership scheme in which the employés of the department might take part. For the present he puts forward the following details, failing a general co-partnership system. A bonus to be paid to all men employed in the department. A bonus of 2½ per cent. downwards according to responsibility on so much of the amount certified by the borough accountant to be net surplus profit for the next financial year ending March, 1914. Men who are absent from any cause whatever, except annual holidays, to have a corresponding reduction made in their bonus. Men engaged during the above period to be paid a proportionate sum if they have been employed six months. Any employé going on strike or discharged for insubordination to forfeit all rights to any bonus. Any man discharged for slackness or who leaves to better himself to obtain the amount due to him at the end of the financial year.

The Electricity Committee has not adopted this bonus scheme, but has decided to give the workers an increase of a ½d. per hour.

Dudley.—Sale of Undertaking.—The terms of the agreement for the sale by the Corporation of its electricity undertaking to the Birmingham District Power and Traction Co., Ltd., and the Shropshire, Worcestershire and Staffordshire Electric Power Co., have now been published. The agreement provides:—The purchase money is:—(1) £63,400, together with the balance of loans (and interest) raised by the Corporation for the purchase of the undertaking; (2) the sum of £10,500, of which £7,000, with interest, shall be made by the Power Co. in 17 equal annual instalments of £550 each; (3) £3,334, the amount expended by the Corporation on capital account for the purposes of the undertaking since March 31st, 1912. The agreement dates from April, 1912, from which period to the completion of the purchase, the Power Co. takes the income due from the consumers. The accounts of the Corporation are to be made up to within a month of the completion of the purchase, and if a profit is shown, it is to be paid to the company; if a loss, the latter pays. The purchasers are to take over the engineers, clerks, workmen, and other persons in the employment of the Corporation exclusively for the purpose of the undertaking. It is stipulated that the prices for electricity to be charged to the consumers by the company are not to exceed those at present in force, but they may be increased at the end of three years with the consent of the Corporation. If that consent is withheld, the matter will be referred to arbitration. The Corporation has the power to repurchase in 42 years. There is nothing in the agreement making it obligatory on the part of the company to keep the present generating station.

Harrogate.—Plant Extensions.—The T.C. has applied to the L.G.B. for a loan of £6,939 for a turbo-alternator and condensing plant for the electricity works.

Haslingden.—The new sheeting looms which have been placed in Messrs. James Lambert & Son's Carr Hall Mills, are being electrically-driven. These are the first looms in Haslingden to be electrically-driven.

Hinckley.—The U.D.C. has approached the Leicestershire and Warwickshire Electric Co. for terms for supplying current to the new hospital to be erected, for a term of 20 years.

Hull.—Loan Refused.—The L.G.B. has declined to sanction borrowing powers to the Corporation for various furnishings, which include four electroliers for the Council Chamber of the Guildhall, which were to cost a total of £500.

Launceston.—Public Lighting.—The T.C. has received from the electric supply company an offer to light six public lamps, from November to February, to 4 a.m. at £5 10s., and to 7 a.m. at £8 10s. The offer has been referred to the Lighting Committee.

London.—According to the *Standard*, 50 firemen, with engines, &c., were called in on Thursday, last week, to put out a fire which occurred through a gas main leaking in Fenchurch Street, involving the electric light and telegraph cables near by.

Preston.—Remedial works and extensions in connection with Penwortham's sewerage system formed the subject of an inquiry before a L.G.B. inspector on August 21st, when the R.D.C. made application for sanction to borrow £6,800 to cover the cost. It is proposed to discontinue the use of two oil engines at the outfall works, replacing them by electrical plant to be erected at the ejector station. In regard to the substitution of electric for oil power for ejection purposes, counsel for the authority said the cost of oil power was estimated at £670 a year, and that for electricity would be £150 per annum, or a saving of £520. The total capital expenditure for the purpose of electricity, including the erection of a new engine house, motors, land, cables, &c., would be about £400, so that it would be saved by the change in the first year. Mr. T. Kitson (chairman of the P.C.) thought it would be well for ratepayers to know the great saving effected by substituting electric for oil power. The rate would be no less than 11d. in the £ for oil power, and 2d. for electric power. On that ground alone the ratepayers should be agreeable to the change. No opposition was advanced to the application.

Rawtenstall.—The lighting superintendent has been instructed to make arrangements for the lighting of Hall Carr Road by electricity.

Owing to the increase in the number of consumers, an extension of the cables in the Waterfoot district is contemplated. The H.T. cable to Bacup is heavily overloaded, and an additional length of feeder is to be provided to join up with the length which is being laid by the Bacup Corporation.

Rishton.—The B. of T. has made an order to permit the Accrington Corporation to supply electricity to the Rishton paper mills.

Sandiway (Cheshire).—In response to a request from the Weaverham Electric Supply Co., which stated that it was being pressed on all hands for the electric supply to be available in November in the Cuddington and Sandiway district, the Northwich R.D.C. has consented to the erection of overhead mains in Sandiway and Cuddington.

Scarborough.—Workhouse Lighting.—The Guardians are proposing to light the whole of the workhouse with electricity, but progress is delayed by wrangling over the estimates of cost of a heating scheme which is to be carried out at the same time.

South Africa.—At a special meeting of the Cape Town City Council, held on August 2nd, a report of the Electric Committee, recommending increased generating plant, was brought up for adoption. The Committee reported that the total output of the power station on July 11th, 1913, was 2,554 KW., while the total capacity of the available plant, without the new turbine set, was only 2,600 KW.; and that, in addition to the ordinary expansion of the undertaking, the following additional demand had to be provided for before next winter, viz.:—Salt River Works, 500 KW.; Claremont Power Station load, 250 KW.; Messrs. Ohlsson's Cape Breweries, Ltd., 150 KW.; Messrs. Daniel Mills & Sons, 50 KW.; Messrs. Verster & Co., 50 KW. The Committee recommended the purchase of a Thomson-Houston generator, Allen condenser, and Kinetic pumps, including spares, switchgear, &c., for £6,982; also a Peebles converter, including A.C. and D.C. switchgear, for £2,740; the total cost of plant, including foundations and erection, being estimated at £11,000. The Council agreed to the recommendations of the Committee.

The tender of Messrs. Cunningham & Gearing for the wiring of the new pier, pavilion, tea rooms, bandstand, &c., has been accepted by the City Council.

Sturry (Kent).—Electricity Scheme.—At a meeting of the Bridge Rural District Council, on August 21st, a letter was read from Mr. G. Stainton, of Whitstable, stating that a company was about to be formed to carry out an E.L. scheme for Sturry and district, and intimating that, when ready, the engineer's report, with details of the project, would be laid before the Council. The Council decided to defer consideration of the matter pending the arrival of the report.

Weaverham (Cheshire).—The Electricity Supply Co. has applied to the B. of T. for consent to the use of 220-volt overhead lines; five lines are proposed to be erected forthwith, and six others as occasion requires.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The Corporation has adopted a revised scheme for the extension of ½d. distances on the tramways.

Acton.—The clerk to the U.D.C. has prepared a report with reference to a conference between representatives of the Council and the Middlesex C.C. concerning the proposed linking-up of the Middlesex Tramways with the London United system. The engineer and tramway manager of the County Council, he says, submitted a plan for a connection between the two systems by way of King Street. After considering the advantages and disadvantages of this route, the members inspected a suggested connection by way of the Steyne, either through Rectory Road or Steyne Road. Another suggested connection through Market Place was considered, but it was felt that the cost of this route would be prohibitive. The report will come before the Council at its first meeting following the vacation.

Ashton-under-Lyne.—At the time of going to press, no settlement had been arrived at with the workers on the Ashton Corporation, Stalybridge Joint Board and Oldham Ashton and Hyde tramways, and as the men's notices are being handed in, there is every prospect of a tramway strike in this district.

Asiatic Turkey.—According to *Commercial Intelligence*, English engineers are surveying routes for an electric tramway from Moazzam, 5 miles north to Garova, 5 or 6 miles south of Bagdad. The concession is held by an English firm; a 50-year-old horse tramway is in operation in another part of the city and suburbs.

Australia.—Advent of Motor-'Bus.—According to the *Australian Mining Standard*, the 30 years' monopoly of the Melbourne street passenger traffic by the Melbourne Tramway Co. is being seriously threatened by the motor-'bus. The initial experiment was so successful that the first 'bus company has been followed by a second, which also is doing very well, and numerous other schemes are proposed. According to our contemporary the tramway company has persistently ignored the demands of the public in the past, secure in the belief that the terms of its concession protect it from all serious opposition.

The same journal gives particulars of public meetings which have been held at Camberwell and Hawthorn, to insist on steps being taken to supply the tramway needs of these suburbs.

Batley.—The Works Committee of the Corporation has agreed upon terms with a company for the construction of tramways to Shawcross and Dewsbury Moor.

Blackpool.—Growing Tramway Receipts.—A report presented to the Corporation Tramways Committee on August 21st showed increased receipts to date of £6,150. From April 1st to August 14th the receipts were £42,250, or £5,049 more than in the corresponding period of last year. The receipts per car-mile averaged 1s. 11¼d., or 3d. per car-mile more than last year.

Continental Notes.—Germany.—After being under consideration for a period of six years, the scheme promoted by the A.E.G. for the construction of an electric railway between the Berlin district of Gesundbrunnen and the suburban town of Neukölln has just received the sanction of the supervising authorities. Almost four years of this term have been occupied in negotiations with the municipal council, the balance of two years representing the time devoted to securing the approval of the Government departments concerned. As projected, the railway is to be a combination of the overhead and underground type, as in the case of the existing Berlin Elevated and Underground Railway, but the municipal authorities have insisted upon a longer portion of the railway being constructed underground than had been contemplated by the A.E.G. As this variation will necessitate a larger expenditure than was expected under the original scheme, the municipal authorities have decided to defray a portion of the additional expense by undertaking to make a contribution of £295,000 towards the cost. The agreement made to this effect was concluded on February 1st, 1912, and would have expired on August 18th, if the Government consent to the railway had not been granted by that time—or, at all events, the municipal authorities would have been entitled to withdraw from it. The railway is to have a total length of 5¾ miles and is expected to involve an expenditure of £4,500,000. The traffic is estimated at 60,000,000 passengers per annum, and the fares will range from 1½d. up to the fourth station, 2d. to the eighth station and 2½d. to the fourteenth and terminal station. It is assumed that the authorisation of this railway indirectly implies the rejection of the rival scheme for the construction of a suspended electric railway also between Gesundbrunnen and Neukölln.

Switzerland.—According to the *Times*, the difficulties connected with the working of the Lötschberg Electric Railway have been sufficiently overcome to enable a full train service to be run from September 18th onwards.

Colwyn Bay.—The Llandudno and Colwyn Bay Tramways Co., whose present Colwyn Bay terminus is in the centre of the town, has decided to continue its lines in a westward direction through the village of Old Colwyn, a distance of nearly two miles. The work will be commenced in October.

Dublin.—On Tuesday morning a large number of drivers and conductors on the Dublin United Tramways struck work, leaving the cars on the streets. The city police have been reinforced, and the military are being held in readiness. The greatest confusion prevailed on Tuesday, the streets being crowded from the Horse Show. Inspectors and clerks had to work the cars back to the sheds. Other vehicles reaped a big harvest. A number of men who left their cars on the streets were charged by the manager of the Tramway Co., and taken into custody. A temporary service was established by the officials of the company and outsiders who volunteered their services.

Glasgow.—The Tramways Committee proposes to increase the wages of certain classes of motormen, conductors, and other workers, involving an additional annual expenditure of £9,500.

Representations having been made by the district secretary of the Electrical Trades Union regarding handy men in the department doing electricians' work at Caplowhill Car Works, conferences with Union officials and men have taken place, and the T.C.'s Committee now recommends that handy men should continue to perform the work at present done by them, with the exception of the work of making the connection at the coupling between the trolley-pole and the trolley base, which work should in future be carried out by a wireman.

Keighley.—At a meeting of the T.C. last week, it was reported that the B. of T. had consented provisionally to the use of electrical power for three months from August 1st on the railless trolley system already opened. The Electricity Committee also reported receipt of sanction to extend the period for the commencement and for the completion and opening for traffic of the tramways authorised by the Keighley Tramways Order, 1909, until September 20th, 1914, and September 20th, 1915, respectively, and to extend the time for completion and opening for traffic of the tramway from Dale Street to Stockbridge, authorised by the Order of 1903, until August 11th, 1914.

Leeds.—New Tramways.—The sub-Tramways and Electricity (Extensions) Committee of the Corporation has resolved that application be made for powers to make the following extensions: Tramways—from Burmantofts Road to Compton Road; from York Road to junction with present line in Easy Road; from present terminus in Dewsbury Road to Old Lane; from junction of Swinegate with Bishopsgate Street, to Lower Briggate; from Sovereign Street to Swinegate; from present terminus in York Road on Selby Road route to Hollyshaw Lane; from present terminus in York Road to Seacroft Hospital. Railless—From junction of Wellington Road and Tong Road, to Low Road; from junction of Whitehall Road to Chapel Lane, near Recreation Ground.

Little Hulton (Lancs.).—Official Inspection.—On Friday last Col. von Donop, of the B. of T., inspected the new tramway of the South Lancashire Tramways Co. The new line is from Long Causeway, Farnworth, through Little Hulton, to the Monument at Walkden. It was proposed to open the line for traffic last Saturday, but Col. von Donop refused his sanction for an immediate opening on account of the fact that an objection was made by the L. and N.W. Railway Co. on the ground that two of their bridges, which the track crosses, were not sufficiently strong to bear the strain of the new traffic.

Longridge (near Preston).—The Council has resolved that in the event of the Preston Corporation asking for powers for the extension of its tramway system, the Longridge Council should approach the Corporation with a view to including Longridge in its area.

Manchester.—All-Night Services.—The Corporation Tramways Committee on Tuesday had before it a report by Mr. McElroy (general manager) upon the subject of all-night services of tramcars, and it was decided to recommend to the City Council that such services be inaugurated on eight routes. Mr. McElroy, in his report, said that after careful analysis of the petition from the night workers of the city, it was now possible to gauge the extent of the demand for all-night services of tramcars. The greatest demand was in Cheetham Hill, Harpurley, Moston, Newton Heath, Moss Side, Rusholme, Longsight and Levenshulme. In his opinion an hourly service of cars on eight routes which he suggested ought reasonably to meet the demand at the present time. From the point of view of the tramways department, there were objections to the running of an all-night service, the principal one being that it made the efficient maintenance of the track and overhead equipment more difficult. The department, however, would endeavour to carry out the minor repairs during the intervals between the running of the cars, and when more important repairs or reconstructions were necessary, the services would have to be run by means of motor-'buses. He recommended that the services be limited to week nights only. There was only one instance in the United Kingdom, said Mr. McElroy, of the running of all-night services, viz., in London, but in the U.S.A. it was quite a common practice to run such services. In New York City there was a 10 minutes' service running all night. In Manchester the fares will be the same as in the daytime, but there will be no workmen's tickets.

The employés of the Manchester Tramways Committee on Tuesday applied to the Committee for an advance in wages, an extended holiday, and improved conditions of service. The men state that the cost of living in Manchester has increased to such an extent, that they feel justified in asking for the advance.

Morecambe.—Electrification Scheme.—By a majority of a single vote the Electricity Committee of the Corporation has instructed the electrical engineer to prepare a scheme for the electrification of the tramways, and this resolution has been approved by the Council. This question is a very sore point in Morecambe, one of the few towns in this country which still depend entirely upon a horse tramway service. It has been time and time again urged that the present antiquated system stamps the town, in the eyes of visitors—its chief mainstay—as unprogressive. On the other hand, it has been held that the visitors like the easy-going slow jog-trot ride along the sea-front on the horse cars, and look upon it as a cheap char-à-banc ride. Four years ago, at a town's meeting, the ratepayers declined to allow the Corporation to proceed with a Bill for electrifying the tramways. Though the resolution does not commit the Corporation, it is thought necessary to obtain all possible information in view of a future need if not an immediate change.

Ramsbottom.—During the first week of the running of the new railless trolley cars, two of which have been in service, 10,600 passengers have been carried.

Southend-on-Sea.—The T.C. has applied to the B. of T. to extend the limit of the amount the Council is authorised to borrow under the Light Railway Orders, 1899 to 1912, by a further sum of £16,900, to cover the cost of laying double lines in Southchurch Road and Southchurch Beach Road.

TELEGRAPH and TELEPHONE NOTES.

Brazil.—A decree has been signed granting a concession to Marconi's Wireless Telegraph Co. for the establishment of international stations at Rio de Janeiro, Belem, Trinidade, Santa Martha and Fernando de Noronha.

Isle of Man.—The Postmaster-General has notified a large number of telephone subscribers in Douglas that their service will be discontinued, in consequence of the Douglas T.C. having refused the terms he has offered for wayleave over municipal property. The rent offered was £5 a year; the Town Council demanded £25.

Japan.—Wireless telephony is making progress in Japan, a system invented by a Mr. Torikata having been adopted by the Government, and by the Nippon Yusen Kaisha on their mail steamers.

London Telephone Service.—In reply to a request for statistics showing the relative efficiency of the London telephone service during the present year as compared with the year 1911, when the service was partly in the hands of the National Telephone Co. as well as of the Post Office, Mr. Herbert Samuel recently gave the following table, showing the percentages obtained by the special observation of about 50,000 calls in each half-year:—

January to June.	National Telephone Company. 1911.	Post Office. 1911.	Post Office combined system. 1913.
Average speed of answer ...	5·8 sec.	5·1 sec.	5·1 sec.
Percentages of total calls—			
"Engaged" calls	18·6	18·9	17·4
"No-reply" calls	4·5	2·9	4·1
"Cut-offs"	·7	·4	·6
Effective calls	65·9	68·7	70·5

He stated that the number of complaints during the last 12 months had very largely diminished.

New Cable.—The Post Office has decided to lay a new telegraph cable to Germany, to meet the growing demand on the intercommunication between the two countries. The cable will contain four wires, and will start from a point in Norfolk. There are already four similar cables in use.

Telegraph Rates.—The Great Northern Telegraph Co., Ltd., announce that on and after September 1st next the rates to the undermentioned places in the Far East will be as follows:—To Hong-Kong, China and Manila, 3s. 6d.; to Japan and Formosa, 3s. 11d.; to Dutch Indies, 3s. 7d. The rates now in force are:—Hong-Kong, China and Manila, 4s. 5d.; Japan and Formosa, 4s. 10d.; Dutch Indies, 4s. 5d.

The following reduced rates are to be brought into effect by the Eastern Telegraph Co. between Europe and the Far East on September 1st:—China, 3s. 6d.; Japan and Formosa, 3s. 11d.; Dutch Indies and Dutch Borneo, 3s. 7d.; Philippines, 3s. 6d. to 4s. 3d.; Straits Settlements, 2s. 10d.; British North Borneo, 3s. 2d.; French Indo-China, 3s. to 3s. 8d.; Siam, 3s. 6d.

Telephone Wires Cut.—A number of telephone wires connecting public call offices at Tube and District Railway stations in the Metropolis were cut by Suffragettes last week.

Trunk Telephones.—According to a statement issued last week, last year the Post Office controlled 3,180 trunk lines, aggregating 117,900 miles; the receipts were £912,342, and the calls averaged 38·8 per trunk circuit per day. In the previous year a slightly higher average was registered. The average cost of operating each call is 1·26d. The average fee per call is 6·11d. The total number of calls was over 35 millions.

Wireless Telephony.—The statements of Mr. Godfrey Isaacs at the meeting of the Marconi Co., which are reported elsewhere in this issue, regarding the company's work in connection with wireless telephony, have led Mr. H. Grindell Matthews to write to the Press, challenging the Marconi Co. to a test of the respective systems under conditions to be laid down by an independent authority.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia. — Brisbane.—September 24th. Ironwork, cast-iron pipes, iron poles, galvanised iron wire, for the P.M.G. See "Official Notices" August 15th.

Perth.—October 8th. Bolts for the P.M.G. See "Official Notices" August 22nd.

September 10th.—For the P.M.G.; nine sections of a trunk line switchboard.

November 12th.—Lamp signalling trunk line switchboard, of five sections, &c.

Melbourne.—October 7th. Electrically-driven machinery for operating pneumatic tube services. See "Official Notices" August 22nd.

November 4th.—Automatic switchboards for exchanges in metropolitan network. See "Official Notices" August 22nd.

September 9th.—City Council; electricity meters and maximum demand indicators. See "Official Notices" August 22nd.

September 16th.—For the P.M.G.; a common-battery or an automatic switchboard.

September 16th.—Corporation. 175 yd. 0·25 sq. in. three-core lead-covered cable; 5,471 yd. 0·15 ditto, and 3,500 yd. ·05 ditto. Also three 250-K.V.A. three-phase transformers. See "Official Notices" to-day.

September 23rd.—Sulphate of copper, for the P.M.G. Specifications from the Commonwealth Office, 72, Victoria Street, S.W.

October 14th.—A common-battery multiple switchboard.

November 4th.—Eight automatic telephone switchboards.

New South Wales.—October 15th. The Government Railways invite tenders for the supply of 13 D.C. motors, to specification No. 412. Specifications are obtainable at the Electrical Engineer's Office, 61, Hunter Street, Sydney (price 2s. 6d. each).

Sydney.—October 15th. For the P.M.G.; measuring instruments, telephone parts and switchboard parts. Particulars from the Commonwealth Office, 72, Victoria Street, S.W.

Victoria.—November 12th. For the Victorian Railways; flame arc lamps.

Basingstoke.—September 17th. Corporation. (Section *a*) Diesel generators, balancer set and booster set; (*b*) storage batteries; (*c*) switchboard and instruments; (*d*) cables and cable laying; (*e*) overhead travelling crane. See "Official Notices" August 22nd.

Belgium.—The municipal authorities of the little town of Henri-Chapelle (province of Liége) have just invited tenders for the concession for the supply of electrical energy for lighting and power purposes.

Bradford.—August 30th. Machinery and timber, for the Corporation Tramways Department. See "Official Notices" August 8th

Cardiff. — September 12th. Corporation. (1) One 2,000-KW. turbo-alternator, with surface condensing plant and auxiliaries; (2) one 700-KW. rotary converter; (3) boiler house plant. (*a*) Water-tube boilers, super-heaters, stokers, &c.; (*b*) turbine-driven feed pump and heater; (*c*) fuel economiser. See "Official Notices" August 22nd.

Costa Rica.—LIMON.—Installation and working of an electric light service in the city and its suburbs. Plant required: Two 414-H.P. Pelton turbines, two 400-KW. generators, and six transformers. The date when tenders will be adjudicated upon will be settled on September 18th. Particulars and plans from the Ingeneiro Municipal, at Limon.

Dartford.—September 16th. U.D.C. (*a*) Water-tube boiler, economiser, fan, steel chimney and accessories; (*b*) inverted rotaries, transformers, switchboard and cabling. See "Official Notices" to-day.

Edinburgh.—September 8th. Electric light and power installation at the new Town Hall, High Street, Portobello. Particulars from Mr. Newington, electrical engineer, Dewar Place.

September 22nd.—Corporation. Two mixed-pressure steam turbines and direct-current generating plants, each of 1,500 KW. capacity. See "Official Notices" August 22nd.

Egypt.—October 31st. Egyptian Ministry of the Interior. Machinery and plant required for the installation of electric light in the town of Damanhour.

Germany.—September 20th. The Prussian State Railway authorities at Konigsberg are inviting tenders for the supply and erection of several electrically-operated high-pressure pumps.

Lancashire.—September 9th. Tell-tale clocks, telephones, electric clocks and fire alarms, for the Visitors for Whalley Asylum. See "Official Notices" August 22nd.

London.—L.C.C.—September 1st. Electrical installation (100 lighting points), for the Royal Hill Central Elementary School, Greenwich, S.E. See "Official Notices" August 15th.

September 23rd.—Main high-tension switchgear, including the reconstruction of existing main high-tension switchgear, at Greenwich generating station. See "Official Notices" August 22nd.

Manchester.—September 2nd. The Corporation Tramways Committee invites offers for scrap materials as follows:—Copper, gun-metal and brass; cast-iron, wrought-iron and steel; steel girder rails; points and crossings; rubber, wood, deals, &c.; lamp tops, spent dry cells, &c. Forms from Mr. J. M. McElroy, general manager, Piccadilly.

September 3rd.—Electric light fittings at the Municipal School of Domestic Economy, High Street, Chorlton-on-Medlock. Specifications, &c., obtainable from Director of Education, Education Offices, Deansgate. Deposit £1 1s.

Roumania.—September 4th. The municipal authorities of Tecuci are inviting tenders for the establishment of a central electric lighting station in the town.

Skewen.—September 1st. Electric lighting installation at the Free Library, for Coldfranc Parish Council: The Librarian.

South Africa.—September 10th. Supply and delivery of electric bed lifts, New Hospital, Port Elizabeth.

Spain.—September 11th. The municipal authorities of Castellon de la Plana are inviting tenders for the establishment of a central electric lighting station in the town, and for the laying of supply mains both in Castellon and De Grao.

Wakefield.—September 1st. Water-tube boiler, superheater, stoker, steam turbo-alternator, condensing plant, H. and L.T. switchgear, for the Corporation. See "Official Notices" August 1st.

Warrington.—September 9th. The B. of G. invites tenders for electrical sundries required at the Workhouse, or the Cottage Homes, from October 1st, 1913, to March 31st, 1914. Forms from Arthur Bottomley, clerk, Bewsey Chambers,

West Ham.—September 4th. Electrical fittings for six or 12 months, for the B. of G. Mr. Thomas Smith, Clerk, Union Road, Leytonstone, N.E.

Wimbledon.—September 1st. One 1,500-KW. turbo-alternator, condensing plant, auxiliaries, and 20-ton crane, for the Corporation. See "Official Notices" August 8th.

CLOSED.

Australia.—TASMANIA.—The P.M.G.'s department has placed the following contracts:—Various telephone cables, British Insulated and Helsby Cables, Ltd., Melbourne; battery parts and materials, India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Melbourne; jointing sleeves, F. B. Cook, Chicago; 5 miles wire, twisted pair, Theodore Zwicker & Co., Melbourne; 5 miles wire twisted pair, and 20 miles wire V.I.R, Armorduct Manufacturing Co., Ltd., London; 5 miles cable, two-wire V.I.R., Callender's Cable and Construction Co., Ltd.; 490 protectors, British General Electric Co., Ltd., Melbourne; telephone supplies, J. Bartram & Sons Pty., Ltd., Melbourne; copper tapes, jointing sleeves, G.I., bronze and steel wire, F. Vanderkelen & Co., Melbourne; copper binders, India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Melbourne.

QUEENSLAND.—The P.M.G.'s Department states that the contract for copper tapes, announced in June as given to the Australian Metal Co., Ltd., has been placed with Messrs. Brabant & Co., Brisbane.

CANBERRA.—The Department of Home Affairs has ordered the electric protective apparatus for the overhead lines in connection with the power supply for Canberra from the Australian General Electric Co., Melbourne.

WESTERN AUSTRALIA.—The Postmaster-General's Department has placed orders for metal-filament lamps with Messrs. Dick, Kerr and Co., Ltd., Sydney, and for various telephone cables with the Imperial Electric and Engineering Co., Perth.

A contract for 20 miles of tinned copper wire, rubber-insulated, at £3 19s. per mile, has been placed with Messrs. W. T. Henley's Telegraph Works Co., Ltd, Melbourne.

The Public Works Department has ordered an electric lift for the Perth Hospital, at £428 16s., from Messrs. Unbehaun & Johnstone.

VICTORIA.—The town of Northcote has placed a contract for underground electric cable, at £1,015 with Messrs. W. T. Henley's Telegraph Works Co., Ltd.

The Melbourne Electric Supply Co., Ltd., has placed an order with the A.E.G., of Berlin, for two 5,000-KW. turbo-generating sets.—*Tenders* (*Australia*).

NEW SOUTH WALES.—Three 82-K.V.A. motors for Newcastle workshops, Walsh Island, have been ordered from the Australian General Electric Co.—*Australian Mining Standard*.

Belgium.—Four German concerns and one each Belgian and French last week submitted tenders to the Belgian Post and Telegraph authorities in Brussels for the supply and laying of a quantity of telephone cables in the Namur district, the lowest offer being that of the A.E.G.-Union Electric Co.

Eccles.—The Corporation has accepted the tender of Triumph Stoker, Ltd., Leeds, to equip four boilers with the "Triumph" mechanical stoker.

France.—The results of the adjudication on the tenders sent in on July 20th for telephone and telegraph material for the French Government were: Lots 1 to 4, wall apparatus, Association des Ouvriers en Instruments de Précision, 57·95 fr. each. Lot 5 and Lots 6 to 10, 1,000 wall fixtures, no adjudication. Lots 11 to 13, 1,000 portable apparatus, the same tenderers, at 49·95 fr. each. Lots 14 to 18, 2,000 combined apparatus, type 1910, Compagnie Générale de l'Electricité: Lot 16, 9·98 fr.; Lot 17, 9·48 fr.; and Lot 14, 9·98 fr. Lot 19, 3,000 combined apparatus, type 1910, no adjudication. Lots 20 and 21, 2,000 magnetic coils, Compagnie Générale de l'Electricité: Lot 20, 23·50 fr.; Lot 21, no adjudication. Lots 22 and 23, 15,000 telephone receivers—Société Ind. des Téléphones, Lot 22, 3·99 fr.; Société Française des Téléphones, Système Berliner, Lot 23, 3·96 fr. Lots 24 to 26, 6,000 microphone capsules, Compagnie Générale d'Electricité: Lots 24 and 25 at 1·48 fr., and Lot 26, 1·43 fr.

The results of the adjudication on the tenders returnable on July 31st for 8,000 telephone panels for the French State Railways was in favour of the firm of Wich, of Paris, at 9,400 fr.

Glasgow. — The Tramways Committee recommends acceptance of the offers of the Lorain Steel Co. and Hadfield's Steel Foundry Co. for special track work.

Keighley.—The T.C. has accepted the tender of Messrs. E. Bennis & Co., Ltd., Bolton, (£130) for a Bennis stoker for the electricity works.

Liverpool.—Messrs. Fred Wilkins & Brother, Ltd., Liverpool, have obtained the contract for the electric lighting of the new Arts Building at the Liverpool University.

London.—In connection with the South-Western Railway electrification, 16 Lescole electric distance thermometers have been ordered from the Lescole Co., Ltd., for superheat readings on the boiler fronts at the new power station.

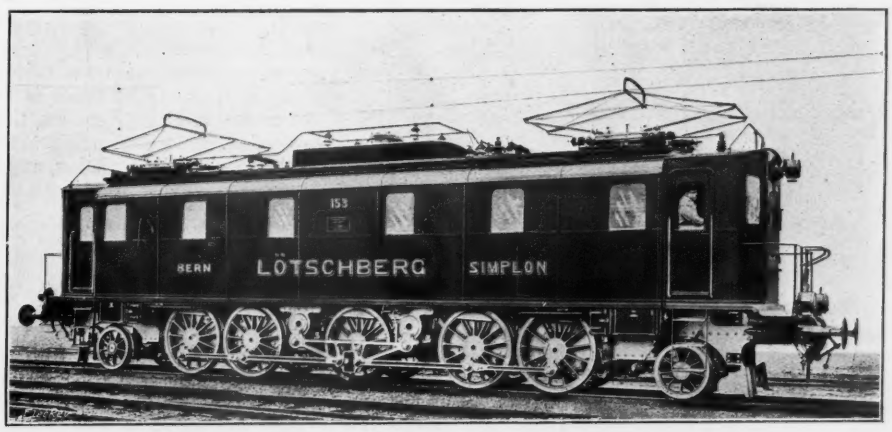
(*Continued on page* 345.)

ELECTRICAL LOCOMOTIVES OF THE LÖTSCHBERG RAILWAY.

[BY OUR BERLIN CORRESPONDENT.]

The recent opening of the Lötschberg Railway marks an important event in international railway working, as the line affords a more rapid connection between Italy on the one hand, and Western Europe on the other. The new railway appeals especially to electrical engineers in view of the fact that electric traction has been adopted at the outset, the locomotives used being not only the largest electrical locomotives so far constructed, but, generally speaking, the most powerful locomotives in the world.

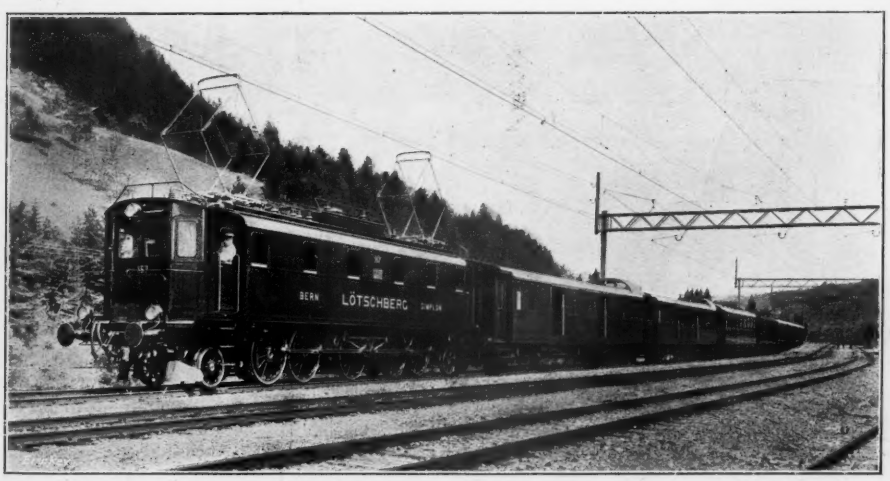
It will be remembered that experimental operation on the Spiez-Frutigen section showed the suitability of the single-phase system for the operation of trunk railways, and electrical operation was definitely introduced in 1910 on this portion of the Lötschberg Railway, the trolley line pressure being 15,000 volts, and the periodicity, 15 cycles. The Oerlikon Co. supplied the first locomotive with an output of 2,000 H.P. during an hour's working at a speed 42 km. per hour, and this was equipped with two motors each of 1,000 H.P. The satisfactory results obtained with this locomotive during the last two years induced the railway company to entrust the Oerlikon Works with the design of 13 locomotives equipped with motors of even greater power, for the through service on the Thun-Spiez-Brigue Line; the electrical part of these locomotives was to be supplied by the Oerlikon firm jointly with Messrs. Brown, Boveri, and the mechanical part by the Swiss Locomotive Works.



2,500-H.P. Single-phase Locomotive for the Lötschberg Railway.

These new locomotives, of which some interesting particulars appeared in our issue of July 12th, 1912, are designed to develop 2,500 H.P. during 1½ hours' uninterrupted service, at a speed of 50 km. per hour, and have five coupled axles and two free axles. The pull on the drawbar at normal speed is 10,000 kg., which suffices for hauling a train of 310 tons over a gradient of 27 per cent., or a train of 530 tons over a gradient of 17 per cent., at a speed of 50 km. per hour, the pull at the wheel circumference being 13,500 kg. The maximum speed has been fixed at 75 km. per hour. The locomotives are able in starting to develop a pull 30 per cent. above the normal figure, that is, of about 18,000 kg.

As regards the mechanical part, the longitudinal frame carries the body of the locomotive, which comprises three compartments, viz., the engine room and the drivers' cabins, which are separated from the former by partition walls and doors. In order to ensure the greatest possible freedom on curves, the central (driving) axle has been given a side-play of 25 mm.; the two inner coupled axles are located rigidly in the frame, and each of the two outer ones, having a side-play of 40 mm., is connected with the corresponding free axle, thus forming what is called a Krauss-Winterthur bogie. In the case of the free axle an even greater side-play has been provided, thus allowing curves of only 120 m. radius to be negotiated in spite of the considerable length of the locomotive. The central axle has spiral springs and the coupled and free axles plate springs.

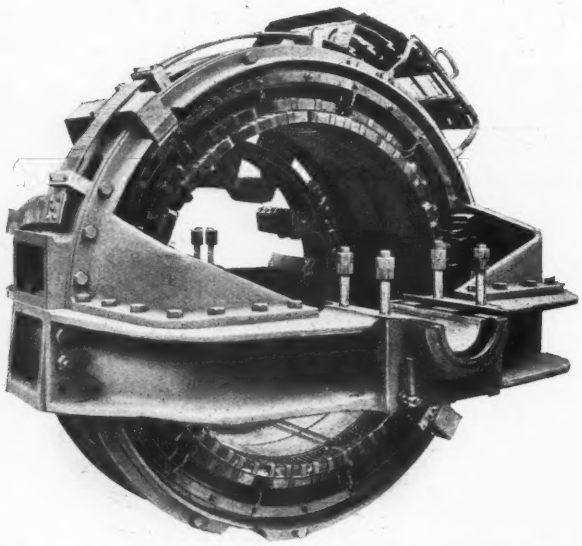


Locomotive and Train, Lötschberg Railway.

The hand brake in each driver's cab acts on the free and coupled axles situated near by and on a brake block on the driving axle. In view of the considerable gradients on the line, the locomotives have been equipped with the Westinghouse automatic brake and a regulating brake. From

the driver's platform are also controlled the whistle and sanding device which, like the collector bow, and part of the safety devices, door locks and ladders, are operated by compressed air.

All the electrical equipment has been duplicated, thus allowing the locomotive to be operated with half of its equipment, that is, with one transformer and one motor and accessories. Provision has also been made for the two halves of the equipment to work either in series or in



Stator for 1,000-h.p. Motor on Experimental Locomotive.

parallel, the two motors being fed from either transformer, so that the locomotive will, for instance, develop its full tractive effort with a single transformer and controller, and both motors arranged in series, and be able permanently to keep up its full speed with one motor.

The current goes from the 15,000-volt line through the two bow collectors over two choking coils, to the two halves of the electrical equipment, viz., through two high-tension oil switches to the two transformers and two earthing slip-rings fixed on the rigid axles, to the rails.

Rotor of 1,000-h.p. Motor on Experimental Locomotive.

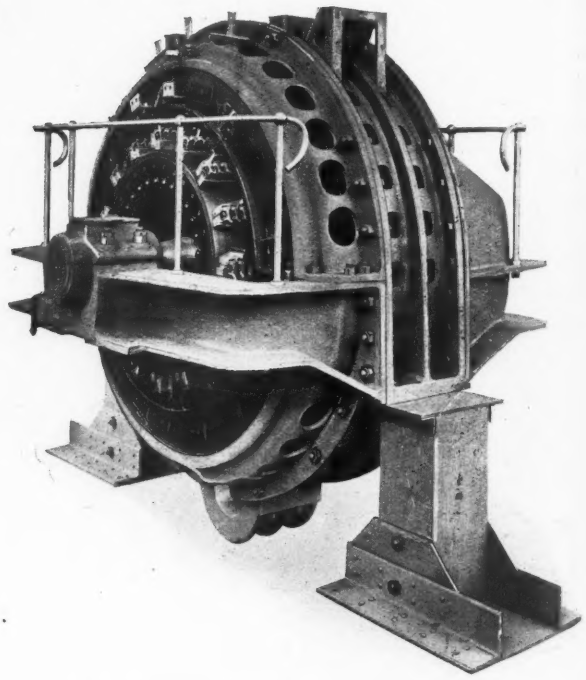
The high-tension oil switches allow the whole of the machinery to be switched off. For the sake of safety there have been fitted on both sides of the oil switches, earthing switches which are closed while the doors of the high-tension compartment are kept open.

The transformers are air-cooled, the low-tension coils having 12 tappings for controlling the speed. A special fan fitted to each transformer ensures thorough cooling.

In operating the controller, perfectly smooth starting with a practically constant pull is obtained, on account of the low pressure difference (45 volts) between the various steps, the power factor being about ·95 with all loads at normal speed. These favourable starting conditions are, of course, of the utmost importance to the power station supplying the line, especially during the simultaneous starting and shunting of several trains.

Fitted on the transformer, and combined with it, is the controller, the contacts of which are connected directly with the low-tension windings of the transformer. All parts of the switch subject to wear are readily exchangeable. Current interruption proper takes place on a secondary drum with magnetic spark damping, whereas any alterations in the connections of the main-switch drum occur under no-voltage conditions. The switching is effected mechanically by a small auxiliary motor fed with direct current, which, through the intermediary of a wormgear, actuates a pawl mechanism. The pawls are controlled by electromagnets energised from the driver's platforms. According as one or other of the pawls is actuated, the switch drum will rotate in either direction, thus making or undoing the connection.

These controller switches, as well as the low-tension oil



Oerlikon Motor for 2,500-h.p. Lötschberg Locomotive.

switches, are designed for a maximum current of 3,600 amperes.

The two motors, each designed to give 1,250 h.p. on the rails during 1½ hours' uninterrupted operation, are of the Oerlikon compensated series type, rigidly fitted into resilient frames. They drive through tooth-wheeled gearing with a ratio of 1 : 2·23, fitted into the motor housing, on to the motor shaft, which is a loose axle connected by the driving gear to the coupled driving axle. The cranks of the two main shafts of the motors are connected by a triangular rigging to the cranks of the driving axles. This arrangement avoids practically any non-resilient part, the spring action in the triangular rigging with the central driving axle being accommodated by a vertical rubbing plate.

The motors are of the 16-pole open type, the air being allowed free access everywhere. They are fed at a maximum pressure of about 430 volts, and are designed to absorb about 3,000 amperes, at their maximum output. A ceiling fan fitted above the motors ventilates the whole of the motor compartment. This motor system which has also been used in connection with the 2,000-h.p. experimental locomotives previously referred to, shows most favourable

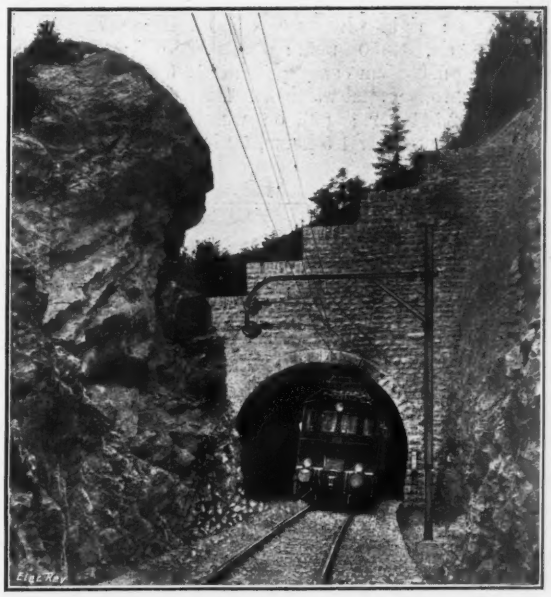
starting conditions, thus greatly facilitating the shunting of the locomotives. In starting at full power, the locomotive only requires about a third of the normal overhead line current. Another advantage of this system is its practical independence of the number of cycles and of any speed limitation by synchronous number of turns. The normal speed of the locomotive is reached with four times the synchronous number of turns of the motors. The power and speed of the motor are also independent within wide limits of the overhead line voltage, any considerable drop in the line voltage being compensated by suitable transformer winding, while the motor with only one-third of its normal voltage, is able permanently to develop its full power. This provides for great overload capacity of the motors at normal pressure.

Fitted direct on to each motor and electrically connected with it, is the controller for reversing the direction of travelling. This alters the current direction in the exciter coil, and is controlled through electro-magnets from the driver's cabin. In case of emergency these controllers, as well as all the remaining apparatus, can be operated by hand.

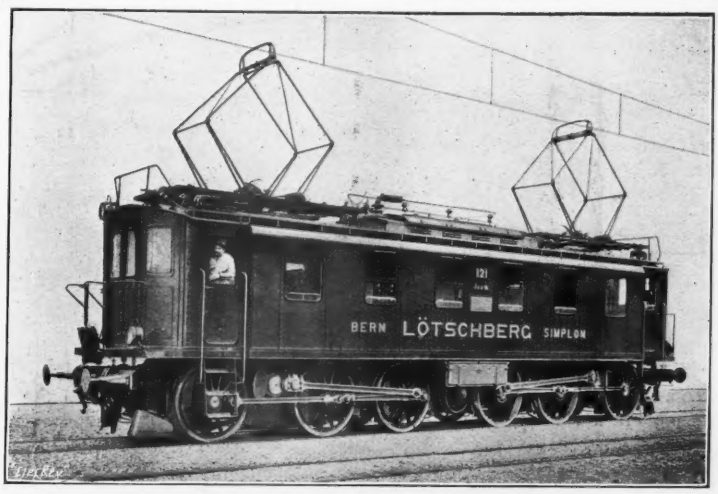
Current for the auxiliary motors and for heating, can be derived from either transformer by means of switch fuses, the heating current being switched in from the drivers' platforms.

A converter set supplies continuous current to the remote control and the lighting, in parallel with four ordinary train lighting batteries, and is also controlled from the driver's cabin. All the requisite switches and instruments are installed in the drivers' cabins.

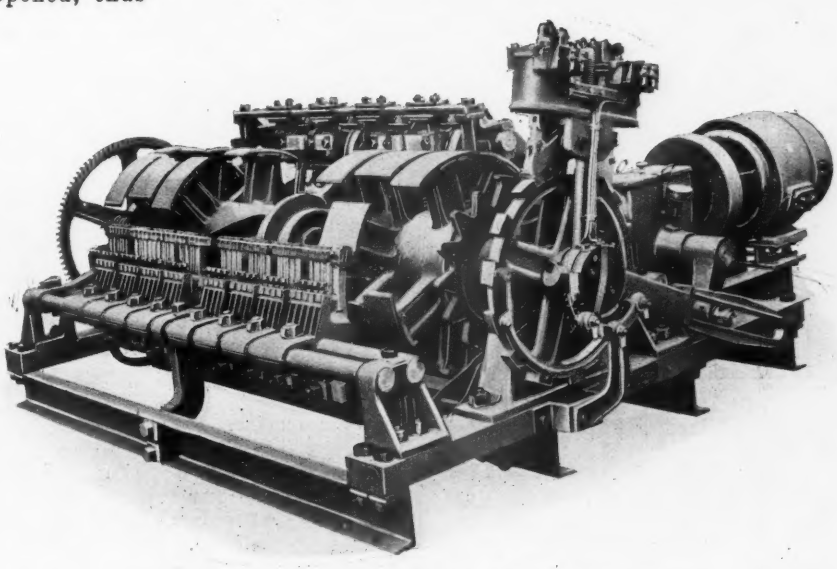
The two high-tension compartments in the motor room of the locomotive are closed by lattice-work doors, which are so locked that the high-tension circuit in front of and behind the high-tension oil switch has to be earthed before opening them. The key used in undoing this lock is arranged on a tap connected to the bow air conduit and cannot be removed unless the tap is opened, thus causing any air in the bow conduit to be discharged. This key cannot be withdrawn from the lock before closing all the doors, thus preventing the high-tension compartment from being opened while "alive." Means have also been provided for the oil switches to be operated by hand only while under no-voltage. In order to keep the operator informed of the actual position of the apparatus in the case of hand operation, signal lamps have been provided for the controller and direction of travelling. The folding ladders for climbing to the roof are mechanically connected with alarm whistles, which are actuated in the event of there being any compressed air left in the bow air conduit on lowering a ladder.



Entrance to Tunnel, Blausee-Mitholz Station.



2,000-h.p. Experimental Single-Phase Locomotive, Lötschberg Railway.



Motor-Operated Controller, 2,500-h.p. Lötschberg Locomotive.

The following is a summary of the principal data :—

General data : Single-phase alternating-current system, 15,000 volts and 15 cycles per second.

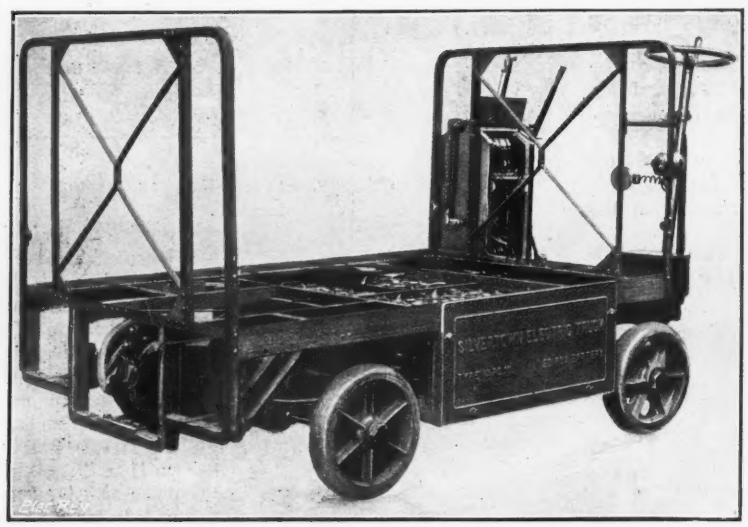
Gauge, 1,435 mm. ; maximum gradient, 27 per mille.

The principal data of the locomotives themselves are as follows : Maximum

length between buffers, 16,000 mm.; total wheelbase, 11,340 mm.; rigid wheelbase, 4,500 mm.; diameter of driving wheels, 1,350 mm.; diameter of free wheels, 850 mm.; maximum axle weight, 16·6 tons; friction weight, 78·2 tons; total weight, 104 tons; output during 1·5 hours, 2,500 H.P.; pull on wheel during 1·5 hours, 13,500 kg.; speed for 1·5 hours, 50 km. per hour.

AN ENGLISH-BUILT ELECTRIC TRUCK.

THE fact that electrically-propelled vehicles are coming to the front in Great Britain, is shown by the recent construction of electric trucks by the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., in regard to which some details may be of interest. The truck frame is built up of channel and angle steel riveted together with cross members

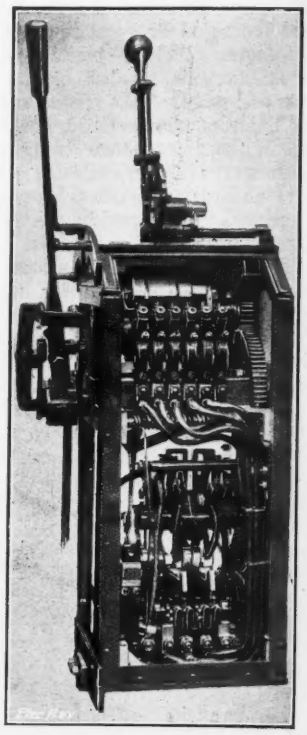


GENERAL VIEW OF SILVERTOWN BATTERY TRUCK.

and stays arranged so as to give ample strength for the load to be carried, and to withstand the road shocks without undue weight. The two side members running continuously from end to end are bent so as to form a pocket to take the battery, and the spring shackle brackets are fixed to a point at the bottom of the battery box so as to take the weight of this part without straining the frame. The latter has an extension at the front end to take the driver's platform, and steel angle ends with easily detachable side rails running from one end to the other in order to secure the load.

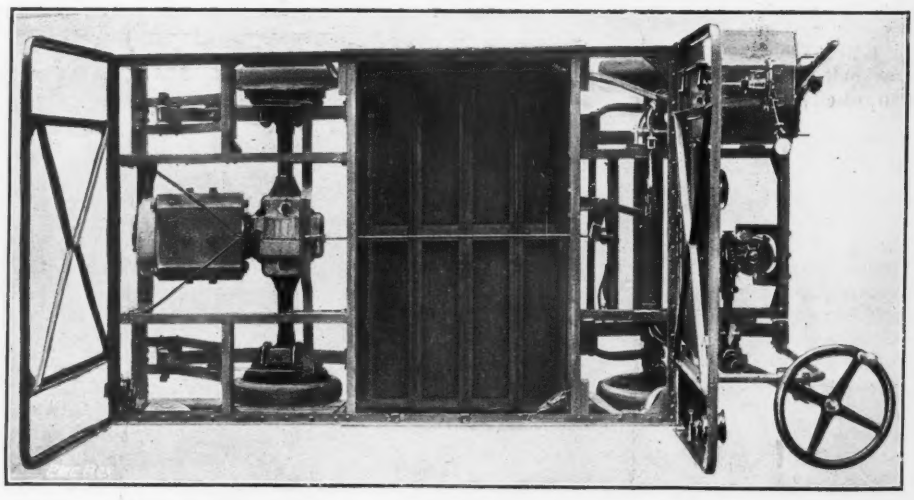
The floor boards which are let into a rectangular channel frame are divided into three parts to allow of convenient removal. The central part covers the battery, the end pieces covering the motor and back axle and the brake adjustments and front axle respectively. The motor is of the four-pole series-wound type with the armature run on ball bearings. The normal rating of the motor is 16 amperes, 40 volts, at 1,430 R.P.M.; it will, however, take a 300 per cent. overload for short periods without injury. The motor is dust and waterproof, but by removing one nut a large aluminium cover can be removed in order to give access to the commutator and brush gear. The connections from controller to motor are made by four sliding spring contacts mounted on one base; these are so arranged that if they have to be removed at any time they can only be replaced in their correct positions.

The motor is bolted directly to the gear-box of the back axle and supported on a hinged bracket fixed to the rear cross member. The springs connecting the rear axle to the frame are



CONTROLLER FOR BATTERY TRUCK.

shackled at both ends and mounted on free spring saddles, so that the motor acts as a combined torque and radius rod. The drive is taken from the motor by a bevel pinion on the end of the armature shaft gearing into a crown bevel wheel mounted on the outside of the balance gear-box, and thence by a spur wheel reduction to the driving shafts, which do not have to carry any weight, but simply transmit the drive to the road wheels. The rear axle casing is built up with a centre steel gear-box, having



SILVERTOWN TRUCK ARRANGEMENT FROM ABOVE.

weldless steel tubes extending through either end carrying the spring saddle, the brake gear brackets and the road wheels. The latter are steel castings, the rear wheel being cast complete with the brake drum. The gearing and road wheels run on ball bearings. The brake shoes are compensated, the brake being applied from a compensating

bar by a rod running through the centre of the truck. The whole of the back axle, motor and gearing forms a complete self-contained unit and leather and felt washers are used to prevent dust from entering the gear or grease exuding from it. The steering pivot is a hardened-steel pin working in hardened-steel bushes, and the weight is taken on large ball thrust washers. The steering is operated by a steering wheel on the driver's right, and the steering gear is irreversible, being of the worm and worm-wheel type. One handle operates the controller and mechanical brake, and is so arranged that the brake cannot be put on unless the controller is in the off position. Another handle operates the switch having forward, electric brake and reverse positions. This switch is interconnected with the controller so as to allow the electric emergency brake to be applied irrespective of the position of the controller, but movement cannot be made from the forward to reverse positions, or *vice versâ*, unless the controller is in the off position.

The controller drum is built up of gun-metal segments, the controller brushes having renewable contact surfaces. The brush holder is designed so that the current passes to the cable thimbles through flexible copper braid, and the controller cannot be moved from one position to another without the current first being broken on a carbon switch. This prevents sparking on the controller segments and brushes, and overheating troubles arising therefrom.

In order to prevent any unauthorised person from handling the truck when the driver is away, a screw plug is provided which, when removed from the car, locks the reversing switch in the electric brake position, in which position the main switch is held open. This same plug has to be inserted in another position in the car before any charging can be done. The truck illustrated has an overall length of about 7 ft., and a width of about 3 ft. 10 in. The clear platform space for goods is 5 ft. 8 in. × 3 ft. 9 in. The wheelbase is 4 ft. and the track 3 ft. 4½ in. The truck was designed to take a 10-cwt. load, and weighs complete with the battery, but without load, 14·5 cwt. The truck has been tested with 14-cwt. loads up gradients of 1 in 5, which it negotiated quite satisfactorily. We understand that a truck of this design has been constructed for the requirements of the General Post Office, and the type is adaptable to special designs for individual requirements, and for different carrying capacities. The trucks can also be adapted to run on rails.

WIRELESS TRAIN CONTROL.

The Prentice Automatic System.

The majority of the systems hitherto proposed for automatically controlling railway traffic have necessitated the employment of ramps and track contacts on the line, together with such mechanical contrivances as tripping levers on the locomotive or the carriages. Others have depended either partially or entirely on magnetic action, and have been electrically worked either directly or by induction. In most methods of inductive signalling hitherto proposed, a momentary warning is given to the signalman in his box as the train passes. Automatic inductive signalling systems have been devised which have answered more or less well in practice, but in almost every instance it has been found necessary to make use of heavy currents in the transmitting circuit which have had a disturbing influence on neighbouring telegraph and telephone systems, thus rendering it impossible to employ them under modern conditions where a large amount of traffic has to be dealt with.

An arrangement has been come to with the London and South-Western Railway whereby the Prentice automatic system of wireless train control is being exhaustively tested on the branch line to Hampton Court. This is not the first test which the new method has undergone, as it has already been installed on a portion of the permanent way of the Canadian Pacific Railway, where it has been found to work satisfactorily.

The chief requirements of an automatic signalling system are that it should give the required indication positively, or if a "normal clear" indication is allowed there must be adequate safeguards ensuring a danger intimation in the event of any failure occurring, or adverse influence being at work. The apparatus on the track must not be affected by any climatic or atmospheric conditions which may obtain; the apparatus on the engine must give a continuous indication as long as the section ahead is blocked, and the system must provide for a direct intimation as soon as "line clear" conditions are restored, whether a train has reached the end of the obstructed section or is still running under control at normal or reduced speed. The apparatus must also allow the driver reasonable freedom as regards controlling his train, and although fixed signals may continue to be employed, the system must satisfy the conditions which would exist were they dispensed with. The apparatus, both transmitting and receiving, must be devoid of complication and reliable, and it is claimed that the Prentice system fulfils all these requirements.

Briefly, it is a method of communicating between the permanent way and the engine cab, which is carried out by means of apparatus similar to that used in ordinary wireless telegraphy. There is no direct electrical connection between the locomotive and the rails, and the connections are such, that as long as the line is free from other traffic, the high-tension current is maintained, and a "line clear" indication given to the driver; should a section ahead, however, be occupied, by means of a track current the oscillating current is broken, and not only are audible and visible signals given to the driver by means of a red light and a buzzer in the cab, but the brakes are applied.

The system includes an ordinary track circuit arrangement, whereby the presence of a train or engine in a section short-circuits a relay; a high-frequency plant, the current from which is controlled by the track circuit relay, and a wave wire of silicon-bronze strung on insulators and protected by troughing of creosoted wood, placed in the centre of the track, for the high-frequency current. An arrangement of antennæ, consisting of a frame on which a number of wires are strung, and termed a "harp," is fixed beneath the engine, and it is by means of this that the radiant energy from the wave wire is received on the engine.

There is also a coherer and a decohering device and relay in synchronism therewith, and a "time" relay to cover the time for decoherence, whereby a continuous holding action is realised as long as radiant energy passes from the wave wire. There is also a master relay and devices whereby the release of the master relay by the cessation of the high-frequency current, causes the exhibition of the danger signal on the engine, the application of the brakes, and the sounding of the audible alarm.

The track circuit is supplied from any suitable source of supply through the transformer. In the experiments witnessed by the representative of the Electrical Review, 110-volt 60-cycle alternating current was used. The secondary is connected to the running rails which are devided into sections of convenient length by insulated joints. The track circuit of one section passes through the relay of the section behind, so that the presence of a train or vehicle causes short circuiting and releases the relay for the section in which the alarm is to be given. The primary of the high-frequency plant is controlled by the relay, and the apparatus consists of transformer, spark-gap, condenser and helix. From the description it will be seen that the wave wire continues to receive high-frequency current unless the de-energising of the governing track circuit relay, by short circuiting, puts the plant out of action.

On the engine the radiant energy from the wave wire is collected by the harp and passes to the coherer, which is continuously rocked by means of a solenoid and a co-operating latch device, the oscillations being at the rate of 80 per minute. The relay which works in synchronism with the coherer is closed when the waves break down the resistance of the coherer, and opened when they cease to act. This causes the master relay to act which controls the solenoids operating the whistle and brake and the lighting of the danger lamp in the cab of the locomotive. The holding relay is provided with a push button whereby the driver

can release the brakes to control the running of the train at discretion through the remainder of the section, but he cannot shut off the red light or stop the blowing of the whistle or the sounding of the buzzer. When the section ahead becomes clear the corresponding track circuit relay is again actuated, re-establishing the high-frequency circuit and restoring the indicator, brake and whistle to the normal "line clear" conditions. It is claimed, and certainly the experiments witnessed by our representative bear out the contention, that the installation meets all requirements as regards safeguards against the non-observance of signals under any conceivable conditions.

REVIEWS.

Wiring Diagrams of Electrical Apparatus and Installations. London: Hill Publishing Co. Price 8s. 4d. net.

This volume contains a fairly complete collection of connection diagrams illustrative of practically all branches of electrical engineering, with the exceptions of telegraphy, telephony and armature windings.

Some of the diagrams are of the most elementary character, whilst others are representative of the latest modern practice. Many of the diagrams are not at all new, but these have been apparently included for the benefit of the switchboard attendant and the like. As the authors state, the reader will obtain information from the book in proportion to his previous training and experience.

The scope of the volume is really remarkable, extending as it does from quite simple generator diagrams, burglar alarms, &c., to the really complex multiple-unit traction diagrams.

The book is well printed, the figures (439 in all) being very clear and to a good scale. The text is reduced to an absolute minimum, being, in fact, practically only a title, the idea being to make the diagrams self-explanatory.

After several laborious hours spent in checking the more extensive diagrams, we are able to say the book is accurate—a most important condition, of course, for a work of this character. The volume should fulfil a useful purpose.—H. G. S.

Wireless Telegraphy. By C. L. Fortescue. Cambridge University Press. Price 1s. net.

The author's aim has been to inform the reader (possessed of a general scientific knowledge) of the accomplishments of "wireless," and the means by which they are obtained. The first four chapters of the work are devoted to an explanation of the electrical terms and apparatus involved; hydraulic and mechanical analogies are used freely and with unusual clearness and accuracy. The author's excellent sketches and clear phraseology should make clear, even to lay readers, the general nature of electromagnetic induction and electrostatic capacity and oscillations. The treatment of the latter is particularly clear, and the reader is neatly led up to an appreciation of resonance, tuning and interference. Chapter III—dealing with electromagnetic waves—includes a number of striking analogies, among which is one giving a rather more accurate conception of electromagnetic radiation than does the time-honoured pond-ripple analogy. Wave-length and methods of varying it are discussed, and in Chapter IV the phenomena of absorption, as affected by light and darkness and atmospheric conditions, &c., are dealt with as lucidly as is possible in the present state of knowledge. The author favours the hypothesis that waves are reflected and refracted on passing from one layer of the atmosphere to another more or less completely ionised. In connection with the avoidance of trouble due to atmospherics, the author refers to the Marconi differential arrangement of two rectifying detectors.

Chapter V deals with transmitting circuits, and the reader is led rapidly from a consideration of the original plain aerial to the more efficient coupled aerial working with a rotary spark-gap. The principle and advantages of the quenched spark are explained, and an excellent *résumé* of the Poulsen and high-frequency alternator systems is given, though, of course, in general terms.

Chapter VI is devoted to receiving instruments, chief among which are naturally various forms of detectors. No attention is paid to the actual apparatus used for tuning nor, indeed, is the actual form of any apparatus illustrated and described in detail. A number of line drawings are included in the illustrations, and though these are only diagrammatic, it is a pity that several of them about this point should be carelessly drawn. Their very simplicity renders the crudity of their execution less excusable.

Chapter VII and the remainder of the book is devoted to a general survey of the uses to which wireless telegraphy is now applied. Wisely enough, the author has not indulged in prophecies, but it is stated that the Marconi Imperial stations will be erected. The uses of wireless on board ship lend themselves to very interesting treatment. It is estimated that nearly 5,000 lives have already been saved by this agency. The operator of the *Republic* hardly achieved "notoriety" by his exploit. A point which may not have occurred to readers is that the repair ships of submarine cable companies are now instructed as to their movements by wireless—a state of affairs very analogous to the installation of electric lighting in gas works.

It will be remembered that the 1912 conference suggested that the operator or other competent person should listen (for distress signals, &c.) for the first 10 minutes in every hour—consider the effect of this on even a five-day voyage, assuming the duty to devolve entirely upon the operator. A reliable call-device is badly needed.

In the later chapters of the book, the Marconi and Telefunken ship stations are well described. Chapter VIII on Land Stations is little more than a readable list of the chief land stations of the world. In the following chapter the author compares the relative merits and prospects of cable and wireless telegraphy. The services rendered by wireless in the development of South America deserve the mention which they receive.

We agree with the author's views as to the great risk of using wireless for naval communications during manœuvres or in time of war. This danger was actually illustrated during the Russo-Japanese conflict. The chapter on wireless for air craft is interesting and satisfactory. The same can be said for the chapter on wireless telephony, and we are inclined to share the author's pessimism concerning the probability of any startling advances in this field in the near future. The volume, which is well worth the price asked, concludes with an historical survey and an excellent abridged bibliography and index.

Prüfungen in Elektrischen Zentralen. By Dr. E. W. Lehmann-Richter. Part I. Second Edition. Brunswick: Fried. Vieweg & Sohn. Price 20 M.

This comprehensive volume should prove of value as a reference book to central-station engineers and others interested in the control and maintenance of electrical plant of every description. The writer is a well-known consulting engineer, who has had ample opportunity to collect data as to the performance and test results to be expected from modern steam and electric machinery, and the book embodies the results of this experience, together with numerous fully-worked and tabulated test figures obtained in actual practice. By the plentiful use of worked examples in this way even non-technical readers, or at least those unacquainted with the *minutiæ* of electrical design, are enabled to follow the whole test fairly readily, although, no doubt, in some cases a little more detail as to the method of actually making the test would be an advantage.

Practically the whole plant of an electric supply station is covered, including boilers, steam piping, steam engines, gas and oil engines, gas producers, mechanical and electrical power transmission, pumps, continuous and alternating-current generators and motors, transformers, accumulators, distributing networks, arc lighting installations and electricity meters.

Besides these there are useful chapters on the economical use of exhaust steam for heating and other industrial purposes, on the use of electricity in agriculture, on photometric measurements and on electricity supply for special

purposes such as X-ray work, ozone preparations and the manufacture of bleaching powder.

The treatment given to the various parts of the subject is a little unequal, and it is doubtful whether the rather detailed theoretical information given about some of the apparatus is necessary in a book like this, which does not profess to take the place of text-books on design. On the other hand, some particulars as to the testing of steam turbine plant should have been included.

On the whole, however, the book is clear and to the point, and the good illustrations and the complete index add to its value for reference purposes.

Fire Protection in Buildings. By H. G. Holt. 1913. London: Crosby Lockwood & Son. Price 8s. 6d. net.

A number of buildings for the use of electrical manufacturers have in the past been designed by the engineers of the firms concerned without any assistance from qualified architects, and for this purpose the whole of the work under review is of interest. It is very doubtful, however, whether this practice is advisable, as there are "tricks in every trade," and certainly the building industry forms no exception to this rule. Provided an architect is employed, he will probably be conversant with the latest practice in fire-resisting construction, hence, excepting for certain sections of the book dealing with internal fittings and the provision of an adequate water supply, we do not think our readers will find much of practical interest. Of these sections the consideration of internal openings and fire-resisting doors offers much information which might often be useful, but the main interest to electrical engineers centres round the descriptions of fire-resisting office furniture and strong-room fittings. The section on fire alarms should, however, be of value to those specialising in electric fittings and equipment of this nature.

Although actual works fittings, such as stores equipment, &c., are not dealt with, a great deal of useful information is given in connection with the fire-resisting value of various materials and constructions which will enable the designer to obtain the maximum of safety from fire risks.

CONTRACTS CLOSED.

(*Continued from page* 338.)

Mexborough.—The Council has accepted the tender of the Dalton Main Collieries, Ltd., for the supply of 1,000 tons of coal for the electricity works, at 12s. 3d. per ton. The tender of Messrs. Herbert Morris, Ltd., of Loughborough, for the supply of a travelling crane, at a cost of £172, has also been accepted.

Peterborough.—The T.C. has accepted the tender of Messrs. Crompton & Co., of Chelmsford, at £576, for a new switchboard.

Stockton-on-Tees.—The Corporation has accepted the tender of Triumph Stoker, Ltd., Leeds, for a "Triumph" mechanical stoker for one boiler.

FORTHCOMING EVENTS.

Association of Engineers-in-Charge.—Wednesday, September 3rd. At 7.30 p.m. At St. Bride's Institute. Annual meeting.

Municipal Tramways Association.—September 24th, 25th and 26th. Annual Conference at Sheffield.

NOTES.

South Magnetic Pole.—Observations made by the staff of Dr. Mawson's Australasian Antarctic Expedition last year, published by *Nature* last week, indicate that the south magnetic polar area lies in the neighbourhood of latitude 71-72° S, and longitude 152° E. The dip at points reached to the N.W. and S.E. of this area was about 89¾°.

Appointment Vacant.—Shift engineer for the Stockton-on-Tees B.C. (32s. to 40s.). See our advertisement pages to-day.

American Railway Electrification.—In referring to the forthcoming electrification of the Canadian Pacific mountain sections, the *Canadian Engineer* gives the following statement of electric railway work proposed and accomplished in the States. The Pennsylvania Railway is contemplating electrifying its line between Pittsburg and New York, a distance of over 400 miles, which will be at least double-track, and which will cost approximately $40,000 per single-track mile.

In the Western States the Great Northern Railway, and the Chicago, Milwaukee and Puget Sound Railway have planned the electrification of 530 and 440 miles respectively, contracts having already been let for road-bed, power, &c. This revolutionary step is occasioned by the poor coal and water conditions with which steam locomotives have to contend in North Dakota, Montana and Idaho, and with hydro-electric power in abundance.

The Denver, Rio Grande and Western Railway is electrifying one of its mountain divisions, 114 miles in length. Some 73 miles of mountain electrification for heavy coal haulage is a very interesting application of electricity in railroading which the Norfolk and Western Railway is planning in West Virginia. The new suburban electrified section of the Pennsylvania, extending from Philadelphia to Paoli, will comprise 70 miles of single track.

Electrifications which have already been made in the United States by steam railroads are as follows in miles of single track:—

Baltimore and Ohio... ... ... 7·4
The original electrification of the steam railroad. The pioneer user of heavy electric locomotives.

New York, New Haven and Hartford ... ...594·8
Including 22 miles on the Hoosac tunnel route of the Boston and Maine, the lines from New York to Stamford, and Providence to Warren (38·5 miles and 109·3 miles); the Harlem River Branch, 141·4 miles; the line from Stamford to New Haven, now nearing completion, 210 miles, besides more than 50 miles of short lines, including a very complete system about Hartford.

New York Central ... ...371·6
Two hundred and thirty-four miles out of New York City, 19 miles on the Michigan Central (Detroit River tunnel), and 118 miles on the West Shore Railroad between Utica and Syracuse.

Pennsylvania... ... ...435·5
Comprising 186·8 miles on the Long Island Railroad, 98·4 miles on the Pennsylvania's approach into New York, and 150·3 miles between Camden and Philadelphia.

Butte, Anaconda and Pacific ... ... 90·0
An ore-carrying mountain line.

Southern Pacific ... ... 96·0
Suburban lines at Berkeley, Oakland and Alameda, Cal., close to San Francisco Bay.

Grand Trunk... ... ... 4·0
Four miles of tunnel track (St. Clair tunnel) at Port Huron, Mich.

Erie ... ... 40·0
In Central New York to the south of Rochester.

Great Northern ... ... 6·0
The electrification of the Great Northern Railway's cascade tunnel, between Leavenworth and Skykomish, about 100 miles east of Seattle.

Inquiry.—Makers of electric fountains are asked for.

Association of Electrical (Station) Engineers.—London Section.—An open general meeting was held on Tuesday last at Chandos Hall, Maiden Lane, W.C., at which the Hon. Secretary (Mr. W. J. Ebben) read a paper entitled "Low Salaries: the Reason and Remedy." The secretary, in his paper, enumerated a number of reasons for the prevailing low salaries in electrical stations, and emphasised the fact that the chief were lack of organisation and the difficulty of overcoming the antagonism to a fighting organisation. He also stated that a large number of station engineers were in the habit of comparing themselves with lawyers and doctors, and yet at the same time accepting less than a labourer's wage for their services; and the low salaries prevailing at present were, in the greater part, the fault of the men who were in receipt of them, because, up to the present, they had done nothing to get an increase. The remedy was that station engineers should rouse themselves from their apathy and that nervousness of combining with their colleagues for what is every man's right—a fair and equitable salary.

A good discussion ensued: amongst other things a member suggested that in a society such as the A.E.S.E, the statement that it was a fighting organisation should be kept in the background, and the hon. secretary, in his reply, wanted to know what should be put in the front. No answer was received.

The next general meeting will be held as above, on Tuesday, September 23rd.

It was reported by the hon. secretary that the A.E.S.E. had obtained several increases in salaries and less working hours in one or two electrical undertakings where there was from 98 to 100 per cent. membership, with very little trouble; the reasons for which, no doubt, were that practically every man in these undertakings was a member of the A.E.S.E., and the moral effect of organisation.

A Strike in London.—On Monday last an extended strike of painters, and other men employed in the building trades, began in London; the employés of the Office of Works came out

on Tuesday, and the electricians on the permanent staff, on learning that non-Unionist painters employed at the Admiralty were at work, decided to join the strike. The electrical staff, which embraces South Kensington, the Eastern Division, Somerset House, the Admiralty, and the Western Division, numbers 700 men. It was stated on Tuesday that, in addition to the departments named above, the General Post Office, the Colonial Office, the Foreign Office, St. James's Palace, Buckingham Palace, the Tower of London, and the Museums would be involved, but this forecast proved incorrect. The origin of the strike was a demand made by the National Amalgamated Society of Painters and Decorators for increased wages, which the Master Builders' Association was not able to grant in full. The employés of the Office of Works demand an increase of ½d. an hour.

The Mazda Half-Watt Lamp.—Although the production of a half-watt lamp has been forshadowed for some time past in electrical circles, the actual demonstration of a series of these lamps in operation by the British Thomson-Houston Co., on Wednesday last, marks a great and generally unexpected development in electric lighting progress. Most of our information up to the present on this subject, has been derived from Continental sources, but we are informed that the new lamp really originated in the research laboratory of the General Electric Co., U.S.A., at Schenectady, New York, the lamps shown, however, being manufactured at the Rugby Works of the British Thomson-Houston Co., under the patent rights to which they are entitled from their association with the American company.

The English company have now produced a number of these lamps at their works, but, of course, some months must elapse before they will be regularly produced on a commercial scale.

The first lamp to be placed on the market will be of high candle-power, from about 300 C.P. to as high as 1,500 C.P. (depending on the voltage of the supply), and possibly still higher candle-power sizes will be developed in the near future. The energy consumption, with a useful life as high as 1,000 hours, will be half a watt per candle-power. The British-made lamps on view were of 1,300 to 1,400 C.P. British standard, and consumed about half a watt per candle-power, as shown by the instruments attached to the exhibit.

An interesting feature of the exhibit was one of the earliest experimental half-watt lamps made at the laboratory of the General Electric Co. This is a 25-volt lamp, taking 20 amperes, and giving 1,200 C.P. at 0·4 watt per candle. It will be seen that the new lamp promises to be a serious rival of the electric arc lamp and high C.P. gas lamp.

The lamps shown were constructed with two thick leading-in wires, from the ends of which hung in a half loop, a relatively short filament about 3 in. in length, composed of a compact closely-wound coil of fine drawn tungsten wire, which operates at a very high current density. The bulb is roughly 8 in. diameter, being the same as employed for the standard 600-watt Mazda lamp, but it is in this case filled with an inert gas; an ordinary screw or other suitable cap can be provided. A very white light is obtained, beside which the light of the ordinary tungsten lamp looks decidedly yellow.

The following data refers to the lamps shown:—

Lamp No.	Amperes, at 80 volts.	C.P. (British standard).	Efficiency: watts per candle (British standard).
1	9·2	1,400	0·52
2	9·15	1,375	0·53
3	9·1	1,260	0·535
4	10	1,600	0·50

The Situation of Trade in Germany.—According to reports in circulation in Germany, the activity in the electrical industry continues very brisk, although it is not uniform in all departments, but new orders are more difficult to obtain and a further depression in prices in the case of certain manufactures has begun. These reports are, however, not fully confirmed by information published by the *Voss. Gazette*, which has made inquiries into the matter, as a result of statements alleging the discharge of workmen by electrical firms. The A.E.G., for instance, states that whilst dismissals have taken place in one department, further workmen have been engaged in other departments, and in so far as discharges have occurred, they have been substantially due to improvements made in labour-saving machinery. It is added that the orders coming to hand are materially greater than in the previous year. In the case of the Siemens-Schuckert Works, the company intimates that not only have no men been discharged, but that additional workmen are being enrolled, as the activity in all departments is very great. The third undertaking which receives consideration is the Bergmann Co., concerning which it was recently reported that fresh orders seemed to be declining. Nevertheless, the total of stock orders on the company's books shows an increase over the corresponding period in 1912, although the turbine branch in particular is less active than a year ago.

Institution and Lecture Notes.—The annual meeting of the German Tramway and Light Railway Association is to be held in Cologne from September 3rd to 5th. Among the papers to be read are one on "Experiments with Metal-Filament Lamps for Tramcar Lighting," and another on "Current Conductors for Electric Tramways." Visits are also to be paid to a number of the engineering works in the district.

Victorian Institute of Electrical Engineers.—On July 24th a paper on "Electric Cookery," by Mr. W. H. Alabaster, was read and discussed.

Educational Notes.—University of London.—The session opens in the Faculty of Engineering, at University College, on September 30th. Particulars are given in our advertisement pages to-day of the degree and diploma courses, special courses and research work, &c.

South-Western Polytechnic Institute.—Particulars of the new session, which begins on September 29th, are given in our advertisement pages to-day.

University of Leeds.—The session begins on September 30th. See our advertisement pages.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The electricity staff at Sale (Cheshire) and the officials of the U.D.C. have presented a 14-day clock to Mr. A. R. Fox, of the Electricity Works staff, on his marriage.

The Aldershot U.D.C. has appointed Mr. Walter Ellis, of Farnham, to the position of shift engineer at the electricity works.

Tramway Officials.—Mr. G. F. Upcott, of Leyton, has been appointed chief traffic inspector by the Light Railways Committee of Walthamstow U.D.C, at a commencing salary of £130 per annum, rising by annual increments of £10 to £160 per annum.

General.—Mr. W. H. Booth, of 8, Queen Street, E.C., who has in hand the water supply of the Australian Commonwealth building in the Strand, has also in hand that for the new building of the Port of London Authority, Trinity Square, E.C. The deep borehole at Ottersham Park recently carried out by him to the Lower Greensand continues to flow at over 4,000 gallons per hour at the surface. This borehole is 1,585 ft. deep, and discharges at 82° F. temperature. The water will rise to 76½ ft. above the surface. There are only three successful boreholes to the Lower Greensand, near London. That at Ottersham is probably at the lowest part of the trough, for it is 400 ft. deeper to the water bearing stratum than it is at the deeper of the other two borings. All three boreholes give practically the same head, showing how very free the Lower Greensand formation is.

The marriage took place at St. Mary's, Cadogan Square, S.W., on August 21st, of Mr. John Price Strange, A.M.I.E.E., of Tunbridge Wells, and Miss Elise Marie Reding. The bridegroom, who is well known in Tunbridge Wells, is the manager of the Electrical Installation Co., Monson Road, and is the third son of Mr. Chas. M. Strange, Tunbridge Wells, the bride being the daughter of the late John Reding, Esq., High Sheriff of Luxembourg. Mr. John Petrie, manager of the electrical department for Messrs. J. & F. May, London, attended the bridegroom in the capacity of best man. After the ceremony the party adjourned to Tricity House, Oxford Street, where lunch was partaken of.

Mr. F. Heppenstall, of Messrs. Johnson & Phillips, Ltd., sailed on the 27th inst. for Canada, for the purpose of attending to the firm's rapidly increasing business in that country.

NEW COMPANIES REGISTERED.

Betulander Automatic Telephone Co., Ltd. (130,717).—Registered August 20th, by Coward & Hawksley, Sons and Chance, Mincing Lane, E.C. Capital, £400,000 in £1 shares. Objects: To acquire from Marconi's Wireless Telegraph Co., Ltd., the several existing rights and patents of Nya Aktiebolaget Autotelefon Betu'ander (of Stockholm), Gotthilf Ansgarius Betulander, Oscar Carlson and Carl Magnus Wessling in various countries in or in connection with the automatic telephone system invented by the said Gotthilf Ansgarius Betulander, and the full and exclusive benefit of and all rights in connection with the system; and all improvements therein throughout the world (except Sweden) and all other (if any) rights, patents, property and details; to adopt an agreement with Marconi's Wireless Telegraph Co., Ltd., for the acquisition of the rights, property and details mentioned in an agreement dated January 18th, 1913, between the said Nya Aktiebolaget Autotelefon Betulander of the first part, Gotthilf Ansgarius Betulander and Oscar Carlson of the second part, Carl Magnus Wessling of the third part and Marconi's Wireless Telegraph Co., Ltd., of the fourth part, as modified by a supplemental agreement between the said parties, dated June 28th, 1913; to carry on the business of proprietors, manufacturers and managers of and dealers in telephonic and telegraphic works, systems, lines, stations and exchanges of all kinds, electricians, manufacturers, generators, accumulators, suppliers and distributors of electricity and electrical energy for telephonic and telegraphic communications (whether wireless or otherwise), and for lighting, heating, traction, motive power or other purposes; newsagents, proprietors, publishers and vendors of newspapers, books, magazines and other literary works and undertakings, advertising agents, receivers, transmitters, carriers and distributors of telephonic and telegraphic messages, telegrams, news, intelligence and messages of all kinds; managers, conductors and performers of all business and service connected therewith; mechanical, electrical and general engineers, &c. The signatories (with one share each) are:—A. S. Birch, 21, St. Andrews Road, Golders Green, N.W., assistant secretary; A. A. Cappelacre, 52, Ellesmere Road, Neasden, N.W., accountant; F. Atkin, 104, Woodside, Wimbledon, Surrey, secretarial assistant; W. W. Bradfield, 40, Albert Hall Mansions, Kensington, W., manager; C. J. Ketteridge, 8, The Gables, Old Town, Clapham, S.W., transfer clerk; H. W. Corby, 81, Cecile Park, Crouch Hill, N., assistant secretary; A. H. Brewster, 20, Eastcourt Road, Woodside, Surrey, private secretary. Minimum cash subscription, seven shares. The first directors (to number not less than three or more than 10) are A. S. Birch, A. A. Cappelacre, F. Atkin, W. W. Bradfield, C. J. Ketteridge, H. W. Corby and A. H. Brewster (provisional directors); qualification, £100; remuneration, £2,000 per annum, and a further £500 for every 5 per cent. dividend paid on ordinary shares in excess of 7 per cent. (maximum in any year, £3,000) divisible. Every certificate numbered 1-70,000, which shall be issued within a period of 12 months from July 31st, 1913, otherwise than to Marconi's Wireless Telegraph Co., Ltd., or its nominees, shall have endorsed thereon express notice that such shares are not transferable during the period aforesaid except with the previous written consent of the said company. Registered office, Marconi House, Strand, W.C.

Portarlington Electric Light and Power Co., Ltd. (130,714).—This company was registered on August 19th, with a capital of £3,500 in £1 shares (3,250 preference), to carry on at Portarlington and elsewhere the business of an electric lighting and supply company in all its branches, and to adopt agreements (1) with the Rural District Council of Cloneygowan; and (2) with Foote & Milne, Ltd. The subscribers (with one share each) are:—E. J. Owen, 66, Victoria Street, S.W., electrical engineer; K. P. J. Jolward, 41, Lyndhurst Road, Thornton Heath, secretary; G. W. Robinson, 64, Adelaide Road, West Ealing, electrical engineer; H. A. Manning, 53, Armitage Road, Greenwich, S.E., electrical engineer; F. W. Cundall, 66, Victoria Street, S.W., electrician; W. J. Richardson, 2, Nunhead Lane, Peckham Rye, S.E., clerk; A. L. C. Brugguneyer, 164, Victoria Street, S.W., merchant. Minimum cash subscription 1,750 shares; no directors had consented to act up to August 13th; qualification, £25; remuneration, £25 per annum, divisible. Registered office, 66, Victoria Street, Westminster, S.W.

Lisnaskea Electric Light Co., Ltd. (4,031).—This company was registered in Dublin on August 21st, with a capital of £1,000 in £1 shares, to carry on the business of electricians, mechanical engineers and manufacturers of and dealers in electricity, motive power, light, &c. The subscribers are:—G. Arnold, J.P., Lisnaskea, 10 shares; T. Maguire, "Munvide," Lisnaskea, horse dealer, 20 shares; J. Bryson, Lisnaskea, merchant, 10 shares; J. McBrien, Lisnaskea, shop assistant, 10 shares; B. Dunne, Lisnaskea, merchant, 10 shares; D. McCalden, Lisnaskea, draper, 10 shares: T. Gavin, J.P., Lisnaskea, 10 shares; W. J. Armstrong, Lisnaskea, hotel keeper, 10 shares. The first directors are G. Arnold, T. Gavin, B. Dunne, W. Armstrong, J. McBrien, D. McCalden, T. Maguire and J. Bryson; qualification, one share; remuneration as fixed by the company. Registered office, Main Street, Lisnaskea.

Kingolite Co., Ltd. (130,753).—This company was registered on August 22nd, with a capital of £10,000 in £1 shares (3,000 6 per cent. cumulative preference), to take over the business and assets of the Kingolite Co. and that of W. B. Coupier & Co., to carry on the business of manufacturers of electrical accessories and lamp shades of all kinds, electrical engineers, &c. The subscribers (with one share each) are:—C. M. Escare, 9, Osborne Road, Thornton Heath, art metal worker; C. Damey, 24, Upper Marylebone Street, Portland Place, W., electrical engineer. Private company. The number of directors is not to be less than three; the first are C. M. Escare (permanent), H. G. Bennett, P. F. Escare, C. Damey and W. J. Owen; qualification (except first directors), 25 shares; remuneration as fixed by the company. Registered office, Pyke House, 19-23, Oxford Street, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

British Westinghouse Engineers' Club, Ltd.—Particulars of £3,000 debs, created August 12th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Clones Electric Light and Power Co., Ltd. (4,026).—This company was registered in Dublin on Agpust 15th, with a capital of £2,000 in £1 shares, to acquire and carry on the business of electricians, electrical, mechanical and general engineers, formerly carried on by Chas. Ferguson, at Fermanagh Street, Clones, Co. Monaghan. The subscribers are:—C. Ferguson, Fermanagh Street, Clones, electrical engineer, 500 shares; H. Gunn, J.P., Diamond, Clones, 100 shares. Private company. The number of directors is not to be less than four or more than six; the first are C. Ferguson, H. Gunn, E. Tierney, A. B. Henry, D. Levinson and W. F. McCoy; qualification, £100; remuneration as fixed by the company. Registered office, Fermanagh Street, Clones, Co. Monaghan.

Omega Electric Lamp Co., Ltd.—Particulars of £900 second debentures created August 11th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Aron Electricity Meter, Ltd. (58,650).—Return dated July 15th, 1913. Capital, £350,000 in £1 shares (225,000 ord. and 125,000 pref.). 125 000 ord. and 124,896 pref. shares taken up. £124,948 10s. paid on the pref., including £52 10s on 104 forfeited shares. £125,000 considered as paid on the ord. Mortgages and charges: £100,000.

A. Hirst & Son, Ltd. (57,889).—Return dated June 7th, 1913. Capital, £5,000 in £10 shares (100 pref.). 100 pref. and 320 ord. shares taken up. £10 per share called up on 100 pref. and 20 ord. shares. £1,200 paid. £3,000 considered as paid on 300 ord. shares. Mortgages and charges: £3,600.

A.E.G. Electrical Co. of South Africa, Ltd. (79,666).—Return dated July 31st, 1913. Capital, £100,000 in £5 shares. All shares taken up. £5 per share called up on 10,000 shares. £50,000 paid. The remaining 10,000 shares are unaccounted for in the return. The Allgemeine Elektrizitäts-Gesellschaft, of Berlin, holds 19,995 of the shares. Mortgages and charges: Nil. The nominal capital was increased from £50,000 in December, 1911.

J. W. Brettell, Ltd.—Debenture, dated July 23rd, 1913, to secure £350, charged on the company's undertaking and property, present and future, including uncalled capital (if any). Holder: G. E. Corfield, Balfour House, Finsbury Pavement, E.C.

CITY NOTES.

Marconi's Wireless Telegraph Co., Ltd.

THE annual ordinary general meeting of the shareholders of the above company was held on Friday last at the Hotel Metropole, Commendatore G. Marconi presiding over a large gathering.

The CHAIRMAN, in moving the adoption of the report (see ELEC. REV., page 308), said that he had little doubt that the report and accounts would afford the shareholders as much satisfaction as they did him. When he had the pleasure of presiding at the meeting last year, he was able then to congratulate them upon the substantial development of the company's business for the preceding year, and to inform them that he anticipated that the business of the year 1912 would show further increase, a prophecy which was fully justified and which he was sure they would agree had been substantially realised. They had endeavoured in the report to dispose of the misunderstandings which seemed to have prevailed in some directions respecting the patents and shares in associated companies, and he hoped they had now made it quite clear that there was no such thing in the accounts as profits derived by means of writing-up shares. He trusted the explanation which they had given was sufficiently full and lucid, and that the system which they adopted was now thoroughly understood by all shareholders. There was another matter with regard to the accounts to which he would like again to refer, and that was the item which appeared under balance of contracts, sales and trading in the profit and loss account. They set out one item only, because, as they had explained on previous occasions, it was not expedient, in fact it would be against the interests of shareholders to give any more detailed information. This question had been fully considered by the board, and it had been decided that it would be most inadvisable for several reasons to furnish more information than they did. There was, however, one thing which it was desirable should be said in order again to dissipate some erroneous impressions which would seem to be in the minds of some shareholders respecting the sales of shares. He wanted it to be clearly understood that the company did not buy and sell shares in the ordinary sense of the words. Such share transactions as they entered into were closely allied with, in fact it would be difficult to separate many of them from, business which would come under the heading of contracts. To give an example, speaking in a general way they might enter into an agreement to erect certain stations, or do certain work, all of which, of course, was the legitimate business of the company, for which it might not be convenient at the time to pay them in cash. In such cases they might receive payment in shares. In due course they would dispose of a number of these shares and turn them into cash. The fact, however, was that the money which they had received for those shares was a payment for contracts executed, services rendered, or whatever the particular consideration might have been. If they were fortunate enough to dispose of shares higher than the par value, or the price at which they had represented payment to them, so much the better for their profit and loss account. During the past year, as was well known, and as they had stated in the report, they benefited in this way, and accordingly they thought it prudent to take advantage of the occasion and allocate £100,000 to a general reserve account. When he addressed them last year and referred to the contract which they had entered into with His Majesty's Government with respect to the Imperial wireless scheme, he little thought that they were on the eve of a campaign, of a nature which he should think had never before been experienced by any private enterprise. He would not for a moment have believed that the spirit of fair play in this country could have reached so low an ebb. Nor would he have believed that for such considerations which obtained in connection with the whole of this campaign a British industry, such as theirs, should have been so imperilled. He would remind them that wireless telegraphy had become an industry of considerable importance, and they were, and for many years had been, the only British company maintaining British supremacy throughout the world in this industry, and always in the keenest competition with foreign companies. They manufactured on a very large scale in this country and gave employment to an immense number of British subjects. He thought that it should not be so easily forgotten that while the company was carrying on a remunerative business for its shareholders and establishing a large British industry, it was also accomplishing work of the highest importance for civilisation, by facilitating and cheapening telegraphic communication between England, its Colonies and foreign nations, besides greatly reducing the peril of ships at sea. Had it been their fault and had they been deserving of the treatment to which they had been submitted because they had been the only company to maintain British supremacy in this wireless industry? It had required the most strenuous efforts on the part of their managers and administrators to protect their interests abroad during all this period, and he was glad to say that they had succeeded in doing so. But it must not be supposed that much of the programme which they had in immediate contemplation when he addressed them last year had not suffered some delay. Their accounts spoke of the progress which they had made, but that progress would have been far greater to-day had it not been for the circumstances to which he had just referred. When their tender for the construction of the Imperial stations was accepted in March last year they considered, as they had every right to do, that they had entered into a definite contract requiring only such minor modifications, if any, that they might be willing to agree to in the actual wording of the agreement itself, and the formality of ratification by Parliament. He used the word "formality," for he could not learn of any instance when a contract had been negotiated by a number of Government departments, all of which were in continuous consultation, each putting forward proposals and suggestions and doing his utmost to obtain everything he thought he could reasonably demand and support, and finally all being parties to the striking of a definite bargain—he could not learn of an instance where Parliament had ever before had recourse to the sledge-hammer power which it possessed of placing a private enterprise in such a position that its only alternative to making further concessions demanded of it, would be the imperilling of its reputation and business throughout the world. Such had been the anxious and responsible position which the directors had had to face, and it was, therefore, with no small degree of relief and satisfaction that they had been able to inform them that, notwithstanding Parliamentary intervention, they did not believe that the altered conditions of the contract would prove of any material disadvantage to the company, but thanks only to the strong position which the company held. They had also great hopes that the company having emerged successfully from such a severe and ruthless attack, its reputation abroad would have been not only maintained but enhanced

Their business generally continued to make most satisfactory progress, and he had the greatest satisfaction in being able to inform them that since the issue of the report, they had received a cable from their representative in Brazil informing them that a concession to which they attached the greatest importance had been signed by the President. Ever since the commencement of 1910 when their negotiations were opened, they had devoted themselves assiduously to securing the means of opening up telegraphic communication between Rio de Janeiro and other busy commercial centres of the great Brazilian Republic and Europe. There was no telegraphic service to which they attached greater importance, and they would be pleased to learn that they had obtained this concession for 50 years. At the earliest possible moment they would form a new Brazilian company which would purchase from them their long-distance rights, together with this concession, and every effort would be made to construct the stations with the least possible delay. The new company would, no doubt, enter into an agreement with the American company, by which the station to be built at Para would conduct a service with New York and other parts of the United States. They hoped that this work would be the start of a new network of stations opening up cheaper telegraphic communication between the South American States, Europe, the United States and other parts of the world, which should not only secure to this company a substantial, increasing and lasting revenue, but add considerably in value to their interests both in the American and other of their subsidiary companies. They regarded the completion of these negotiations as the laying of the foundation stone of one of the most important edifices in the world of wireless telegraphy, which would further cement the business which the company was creating independently of any competition and irrespective of all patent rights. The steady progress of their several subsidiary companies to which they had referred in the report was most satisfactory, and they were each year coming nearer to the time when with the completion of long-distance stations either under construction, or about to be constructed, they would realise the principal source of profit and the one to which they attached most importance to be derived from wireless telegraphy. In this connection shareholders would be pleased to learn that the construction of the long-distance Norwegian station had been commenced, and the consideration and whole-hearted assistance which they were receiving from the Norwegian Government and the officials in its employ would not only enable them to complete the work within the shortest period possible, but added zeal and pleasure to all those who were employed in carrying it out. The report issued recently of the Marconi International Marine Communication Co., Ltd., had placed shareholders in the position of having all information in respect of the progress of that company. Their works were supplying them with installations as quickly as they could turn them out, and it was no easy matter for them to keep pace with the demand. The continuous increase of business necessitated the issue of a further portion of the authorised capital of that company. The shares to which this company was entitled were issued to the shareholders at the price of 5s. premium and were well applied for. The business of the company was sound and continuously increasing, and he had every hope that the dividend for 1913 would show an increase over the 10 per cent. paid for the preceding year. He had reason to believe that the directors of that company intended in the future to pay six-monthly dividends, an interim at the end of the year and final upon completion of the accounts. Their Russian company was also making most satisfactory progress. Its business had far outgrown its capital, and for some time past they had had to give it considerable financial assistance in order to enable it to carry out its orders. A resolution had been passed authorising the increase of the capital, but under the terms of Russian company law, Government consent had first to be obtained. The necessary authority had now been given to the extent of 600,000 roubles, and further authority was asked for a like sum. The shares of the company being of 100 roubles the directors had in contemplation arrangements under which the shares would be available for conversion into £1 shares in a trust company, in order to have a market value for them in this country. A new subsidiary company had been formed in Australia, in respect of which they expected to be in a position to give them more information of an interesting nature shortly. They had other important negotiations pending about which, however, they could not give any particulars at present. Shareholders might rely, however, that as and when they were completed, full information would be immediately communicated to them. The company having agents and representatives in almost all parts of the world and business with nearly every foreign Government, the directors resolved to avail themselves of the opportunity of securing the patent rights of what they were advised and believed to be the best automatic telephone system. That a very considerable business was to be done in automatic telephones there could be no doubt, and the world-wide organisation which they possessed should be an asset of considerable importance to the development of such a business. A new company was about to be registered under the style of "The Betulander Automatic Telephone Co., Ltd.," which would purchase from this company the patent rights and take over the contracts and negotiations which had already been entered into in numerous countries. The system would shortly be in full operation at Marconi House, and those desirous of inspecting it would be welcome. Although there was no doubt that wireless telegraphy was in a condition of rapid development, he thought that it could safely be said that this method of communication was based, and would continue to be based, on the production and utilisation of electric waves. Now, there was no mystery about electric waves to his mind. They could vary in length and intensity, or they might be continuous or discontinuous. There seemed to be a prevalent misconception in the lay mind that continuous waves were in some way essentially different from the discontinuous waves produced by what were called spark systems. Such a view was quite erroneous. The Marconi Co. possessed methods of its own which permitted it to utilise wherever it thought desirable either a spark system or a continuous-wave system, and this was demonstrated to the members of the Advisory Committee during the tests carried out for them between Clifden and Glace Bay. His system of continuous waves was now installed and in working order at the trans-Atlantic station at Clifden. Important tests were now being conducted, but considerable work and time were required before it would be possible to determine in a definite way whether the continuous-wave system possessed advantages for long-distance transmission over the spark system. In any event, he thought it well to make it quite clear that the company possessed efficient methods for utilising either system. As in the past, they had this year applied for several, and what he believed to be, valuable patents which embraced further important improvements in the transmitting and receiving apparatus. He would like, without in any way desiring to belittle the attempts made by others to establish communication by means of wireless telegraphy across the Atlantic, to point out to shareholders that the achievement of telegraphing across the Atlantic was not such an easy matter as it might appear, and he thought that the public, and even distinguished inventors, had erred on the side of optimism with regard to what they expected would shortly be done. During the last few months they had read in the public Press that communication was shortly to be established between Europe and America by means of the Poulsen or the Goldschmidt system. He would like to remind them that Prof. Fessenden, writing in the *Electrician*, issue of February 22nd, 1907, said that in January, 1906—that was well over seven years from this date—he received messages in Scotland from Massachusetts with an expenditure of less than 1 KW. Again, Dr. Poulsen, in the *Electrician* of November 15th, 1907, nearly six years ago, said:—"The engineers of the company are very confident that they will succeed in printing trans-Atlantic messages, and are positive that they will not be limited to telephonic reception." Then, again, with regard to the De Forest system, they had the following extract from the ELECTRICAL REVIEW of April 6th, 1906:—"The daily Press announces that the De Forest Wireless Telegraph Co. has sent messages from its station at Coney Island to Ireland, a distance of 3,200 miles. On one night 1,000 words were transmitted, of which 572 were received and recorded. It is further added that 'when the correct pitch to use for Ireland has been ascertained, commercial work will be started across the Atlantic.' It is then proposed to send messages from San Francisco to Ireland, with two relay stations." None of those systems had succeeded in establishing a service of any kind across the Atlantic. In view of what he said at the meeting last year, no doubt there was some little disappointment at their not declaring a second interim dividend in December last, and also that they should have decided to recommend a final dividend for last year of 10 per cent. on both classes of shares, which, as they knew, represented 17 per cent. for the preference and 20 per cent. upon the ordinary. The unforeseen circumstances, however, which occurred since his last address had dictated a policy of prudence, with which he felt sure shareholders would not quarrel. In a new industry such as theirs, developments were continuous, and led frequently to sudden and substantial demands upon their resources, and they had thought it wise, therefore, not only to carry to reserve the sum of £100,000, but also to carry forward to next account £146,000. They hoped that circumstances such as had prevailed this year would not recur, and they would, therefore, be able in the future to hold their general meeting a month or two earlier than they had been able to do on this occasion. The final dividend of the year must, of course, be declared at the general meeting, when the accounts had been passed by the auditors. At the end of each year, however, they would be in a position to estimate approximately the profit earned during the year, and so decide upon any interim dividend which should be declared and paid at that period. By adopting this course, assuming the business continued to progress as they hoped, distributions would take place six-monthly. Their managing director, Mr. Godfrey C. Isaacs, had been subjected to a great number of most ungenerous insinuations which never could have been made by anyone personally acquainted with him, and which could not be and were not believed by anyone who knew him or who had worked with him. But it would appear that in this country, as in most others, when politics were introduced, an atmosphere prevailed in which there would seem to be let loose some pernicious element destructive of the equilibrium of an otherwise well-balanced mind. He thought Mr. Isaacs merited the most sincere congratulations of the shareholders on having carried on the business so successfully during the past year under the great difficulties which he had referred to, and considering what a great amount of time was taken up in defending the interests of the company, and even in protecting his own honour and reputation, all of which he had done so effectively. Mr. Samuel, the Postmaster-General, speaking in the House of Commons, stated:—"I could wish no worse fate for any of my critics than that in the next world they should be condemned to conduct in perpetuity negotiations of this character under these circumstances." He (Mr. Marconi) could truthfully state that he was sure that Mr. Isaacs on his part could express identical feelings.

MR. GODFREY ISAACS (managing director), in seconding the motion, said he would like to say a word or two upon matters to which the chairman had referred. It would be idle for him for a moment to pretend that the troubles which they had gone through during the past year had not been of an extremely painful nature to him. They were perfectly well aware that all manner of suggestions and insinuations of the most sinister nature had been

levelled at him and it had required all the assistance, the support, the confidence, the loyalty and the encouragement which he had received, first, from their illustrious chairman; secondly, from every single member of the board; thirdly, from every manager and head of department throughout the whole of the organisation, and, fourthly—to which he attached no small degree of satisfaction—the enormous number of letters which he had received from shareholders, not only throughout this country but throughout the whole world, in which they had expressed their deep sympathy and their absolute confidence in him. In those circumstances, and largely due to those circumstances, one had been able to face a condition of things which otherwise became well nigh intolerable. They had had during the past year a trouble far more serious and which occasioned to him and to many of the directors much greater anxiety than the trouble to which he had first alluded—he referred to the most unfortunate accident which befell their chairman. He was quite sure that everybody present sympathised with Mr. Marconi in his accident, and were as anxious as were the board to hear of his progress. It was with a very considerable degree of satisfaction he could say that the chairman had returned to them not only none the worse for the accident, but as far as he (Mr. Isaacs) had been able to gauge, with even greater inspiration than before. During the last six or eight months Mr. Marconi had taken out a very large number of very important patents, patents which he (the speaker) felt were at least as important, if not more important, than the patents which he had taken out in the past. They would no doubt see further important developments in the industry in which they were engaged, and which they looked to the chairman to continue to pioneer, and he was quite confident that as long as Mr. Marconi was with them the company would continue to pioneer that great science of which he was the inventor. They all knew that through Mr. Marconi's genius when they went to sea they were able to receive telegrams with their morning cup of tea from those they had left behind. He (Mr. Isaacs) was not fond of prophesying, but he was going to venture on this occasion to prophesy that the date was not far distant when with their cup of tea in the morning they might hear the ring of a bell, and taking their telephone from its stand might talk to those whom they had left behind. The company had not made a habit of boasting at any time of the work which it was doing, but he supposed they had all read in the newspapers of the wonderful things which were being done by persons, most of whom they did not know, in wireless telephony. Whatever they had read in the newspapers as being done by wireless telephony, the Marconi Co. had done more, but until they were prepared to say exactly what definite results in a practical way could be obtained from wireless telephony it would remain silent. They would, perhaps, at an early date be able to turn wireless telephony to practical commercial account, and it would then be time enough to speak about it. Some of the shareholders had been perhaps not unnaturally disappointed or a little impatient in connection with the progress which had been made by one or two of the Associated Companies. He would ask them to remember that in an industry of that nature a little time was required in any country for its development and the turning of it to a profitable and commercial account. There were innumerable difficulties to be surmounted when they remembered that for the most part one had to negotiate with Governments abroad, and like Governments at home they did not move very quickly. A little time was required for those Associated Companies to pull themselves together and to become profitable investments, and a little consideration and patience was wanted from the shareholders. Personally, he had intended to give some assistance to some of those companies by paying visits to them. He had arranged to leave England early this year and spend a little time in America and in Canada, and also to pay a short visit to Spain, but the circumstances which they had had to meet during the last 12 months had made it quite impossible for him to leave England. He hoped, however, to be able to go both to America and Canada during the coming month. Having thanked the managers, the heads of departments and the whole of the staff for the services which they had rendered the company during the past year, Mr. Isaacs said some shareholders might wonder why they had not allocated a certain sum to the staff as bonus as in previous years. The reason was that at the last meeting the shareholders authorised the directors to dispose of such a sum as they might think necessary for the purpose of establishing a pension scheme. The board had been at work on that scheme, and they were on the eve of completing it. In conclusion, he said he could only repeat what the chairman had told them—that the company continued to progress, and that their attention was being devoted to what they believed would be the most profitable side of wireless telegraphy in the shape of constructing and conducting long-distance telegraph services throughout the world, and every month they came nearer to realising that end. In the course of a little time, when many of the stations now in course of construction were completed, he believed it would be found that they had created a sound, substantial, and a profitable business, which would be entirely independent of whether or not others were able to introduce something which Mr. Marconi had not previously thought of in connection with wireless telegraphy.

A short discussion ensued, and, in replying thereon, MR. GODFREY ISAACS said that the directors knew nothing whatever of a rumour that the company was going to pay a dividend of 30 or 40 per cent. at that meeting. Such a rumour did not emanate from the board, nor from anyone connected with the company. The remuneration of the directors was £3,000 per annum according to the Articles of Association. With regard to the American company, the Chairman at the last meeting gave the shareholders a very complete statement showing exactly the nature of the business which he (Mr. Isaacs) and Mr. Marconi conducted in America.

The report was carried unanimously.

Austrian Works.

THE *United Glow Lamp and Electricity Co., of Buda Pesth*, earned larger profits in 1912, as a result of the considerably increased turnover and the saving in interest which was effected through the augmentation in the share capital. After placing the sum of £14,000 to depreciation as in the preceding year, the accounts exhibit net profits and balance forward of £47,000 as compared with £42,000 in 1911. It has been decided to distribute 10½ per cent. for 1912, being the same rate as in the previous year.

The report for 1912 of the *Austrian Siemens-Schuckert Works Co., of Vienna*, states that the orders received experienced a substantial increase over the preceding year; they included equipment for 34 supply works, extensions of 122 supply works, and 10 electric tramways. Nothwithstanding the enlargement of the works, the company's plant was occupied to the limit of its capacity throughout the year. An unfavourable influence was exercised in the final quarter by political events, and the exports to the Orient, which until then had considerably increased, came to a standstill, whilst the domestic trade also became slower towards the end of the year, and continued slacker in consequence of the general economic and political conditions. After allocating £58,000 to depreciation as compared with a similar sum in 1911, the accounts indicate net profits of £95,000 as against £75,000, and a dividend of 7 per cent. has been declared on a share capital of £1,000,000, as compared with 6 per cent. in 1911.

Stock Exchange Notices.—The Stock Exchange Committee has appointed a special settling day as under:—

Thursday, September 4th.—Melbourne Electric Supply Co., Ltd.—Scrip, fully and partly paid, for £100,000 5 per cent. consolidated debenture stock.

And ordered the undermentioned securities to be quoted in the Official List:—

Buenos Aires Lacroze Tramways Co.—£500,000 5 per cent. consolidated mortgage debentures of £100 each, Nos. 1 to 5,000, in lieu of the scrip.

Melbourne Electric Supply Co., Ltd.—Scrip, partly paid, for £100,000 5 per cent. consolidated debenture stock.

Electric Welding Co., Ltd.—The report states that the accounts for the year to November 30th show a loss, after charging debenture interest, of £1,583, increasing a debit balance brought forward of £36,544.

Newcastle and District Electric Lighting.—The directors have paid an interim dividend at the rate of 3 per cent. per annum on the ordinary shares for the half-year to June 30th.

Escher Wyss & Co.—The report for 1912-13 of Escher Wyss & Co., of Zurich and Ravensburg, whose ordinary share capital is entirely held by the Felten & Guilleaume Co., states that both orders and turnover reached an unprecedented total. Apart from hydraulic turbines and other departments, the business in steam turbines again experienced an exceptional development, and orders for over 50 turbines of 250,000 H.P. are at present in hand. A noteworthy delivery in the year was a turbine of 30,000 H.P. for the Rhenish-Westphalian Electricity Works at Essen, and this has been followed by an order for a second machine of the same size. After defraying interest on loans, and placing £29,000 to depreciation, as against £25,000 in 1911-12, the accounts show net profits of £17,300, as compared with £400 in the previous year. It is intended to pay a dividend of 6 per cent. on the share capital of £260,000, whereas the finances of the undertaking were reconstructed in 1911-12, and consequently no distribution was made.

John Spencer & Sons, Ltd.—The accounts for the year to June 30th, including £4,103 brought forward, show a profit of £74,601. The directors recommend a further dividend of 3½ per cent., making 6 per cent. for the year; the appropriation of £13,160 to renewals and improvements expenditure, setting aside £10,000 for depreciation, and carrying forward £11,667.

Lancashire Dynamo and Motor Co., Ltd.—The *Financier* states that the directors have declared a dividend at the rate of 5½ per cent. per annum, less tax, on the preference shares, payable September 1st.

Mackay Companies.—The directors have declared the usual quarterly dividend on the common shares at the rate of 5 per cent. per annum.

Continental.—NORWAY.—The Société Norvégienne de l'Azota et des Forces Hydro-Electriques, of Notodden, in which Swiss and German financial interests are participants, proposes to pay a dividend of 6 per cent. for 1912-13 on the fully paid ordinary shares as compared with 5 per cent. in the preceding year, and 8 per cent. on the preference capital as in 1911-12. It is now intended to increase the share capital from £2,340,000 to £3,950,000, the issue to be made at a time which is regarded by the directors as appropriate.

BELGIUM.—The General Electric Co., of Belgium, reports a profit of £3,426 for the last financial year.

FRANCE.—The report of the Compagnie Française des Cables Télégraphiques, of Paris, for the last financial year shows a net profit of £17,525.

STOCKS AND SHARES.

Tuesday Evening.

Throughout the Stock Exchange business remains on a very small scale; but, of course, this is only to be expected at this time of year, and signs are not wanting that the public requires only a little encouragement to buy back those stocks and shares that were thrown away during the period of nervousness recently gone through. Even the demand that has sprung up in the last week or two has caused a shortage of stock, and it is only with considerable difficulty that any large amounts can be picked up at the ruling levels. Actually, prices have fallen, in many instances, to such an extent chiefly because the dealers have marked them down—not caring to take more stock, except at these reduced quotations. Any sustained restoration of confidence, however, would be quickly followed by a general marking up, for there are not a great number of sellers to be found at the present prices.

But it is chiefly this restoration of confidence that is required. If it could only be proved that, after the alarums and excursions of the last six months, there would follow a period free from the fears of international complications, little doubt would remain that money would flow back freely into speculative, and what may be termed "semi-speculative," securities. Still, it is not certain that further nerve shocks will not be administered by the mismanagement of affairs in the Balkans; while the Mexican dispute, though not of universal importance, must necessarily affect the many English-owned concerns operating in that country.

Speaking generally, it may be said that the result of the last week's operations has proved a tendency for prices to work towards a higher level; though not a little irregularity has been seen on account of the very natural reaction which followed some of the recent rises. Mexican issues are mostly lower, though here it is worth noting that the falls as a rule have by no means wiped out the rises formerly established.

In the better feeling that came into evidence in the Stock Exchange at the beginning of this week, Home Railways have been one of the first to share, and that to as great an extent as any other market. The Underground issues, which are always favourite speculative media, have come in for their share of attention, and the 6 per cent. Income Bonds of the Underground Electric Railways have been one of the most prominent. The rise here has been helped by the discovery of a bear account in the stock. The First Income Debenture has met with support from investors, and has improved a point to 113. Metropolitans and Districts have been very much to the fore in this movement, and have both made considerable recoveries. As a matter of fact, the market in these two stocks is rather peculiar, as at certain times it will take very little buying or selling to move the quotations a point or even more. Central London issues have moved somewhat irregularly, investors still apparently exchanging their holdings from non-assented into the assented stock. There has been a good deal doing in British Electric issues, which nearly all show substantial rises. The chief honours go to the 6 per cent. and 7 per cent. Cumulative Preferences, which have got up to 87½ and 47½ respectively, about 7 to 8 points above the prices ruling only a fortnight ago. The Second Debenture and the Preferred and Deferred have also shared in the improvement.

The Marconi meeting, which was so eagerly looked forward to, at first caused a little disappointment, as the speech of the Chairman did not contain—as the Stock Exchange had hoped it would—any points on which to found a bull campaign. Certainly the reference to the proposed Brazilian subsidiary is regarded favourably, but as yet not sufficient is known to enable a competent opinion to be formed as to its effect on the parent shares. After being up to about 4½, the shares dropped back at first to 3$\frac{15}{16}$, but further consideration of the speech led to fresh purchases, with the result that the shares are only $\frac{3}{16}$ down from the highest point at 4$\frac{1}{16}$; while the Preference shares, which had been up to nearly 3¾, fell sharply at one time, though on balance they are only ¼ lower.

Other shares in this department have in several instances shown a disposition to react after their recent rises, Anglo-American Deferred going back ¼ to 23½, while falls were also registered by Cuban Telegraph and West India and Panama Ordinary. The search for cheap investments—to which we have previously referred—has led to an advance of another ¼, following upon the rise already established, and the Bonds now stand over par. The same factor has caused improvements in Amazon Debenture and Globe Telegraph Preference.

All Mexican securities have, as was to be expected, been affected by the dispute between that country and the United States, though a recovery from the lowest points has in nearly all cases been made. Mexican Tram Common and the two classes of bonds are all lower on the week, though, at the same time, in the case of the Common shares the fall is only one of 3 points, against a rise of 4½ a week ago; while the 5 per cent. bonds have only lost 1 point of the 5 that they gained during the previous week. Mexican Light and Power Common have been similarly affected, having lost as much as 4 points on balance to 66; as this goes against a recent improvement of considerably greater extent, however, it is not of so much importance as at first appears. The Preference and the second Mortgage Bonds have also been lowered, both losing a point—to 97½ and 80 respectively.

On the whole, the tendency among Foreign and Colonial Electric Tramways has been towards higher levels, British Columbia Electric Deferred and Preferred both following their rise of last week with a further improvement of a point; while some increased activity has been noticeable amongst the Debentures and Preferences of the Anglo-Argentine Tramways Company. On the other hand, Rio de Janeiro first and second Mortgage Bonds are lower, and also the 5 per cent. Debenture of the Southern Electric Tramways of Buenos Ayres. One of the good features of the week has been an improvement of 5 points to 115 in the Common stock of the Canadian General Electric Company; but among other stocks in this department may be noted a fall of 2 in Monterey Light and Power First Mortgage Debenture.

There has been a fair number of rises amongst the English Supply and Manufacturing Companies, several Debentures and Preferences being picked out by the investor on the look-out for high-yielding shares. Also among the Ordinary issues the tone has been better. Westminster Ordinary are ¼ higher at 8½, while St. James' and Pall Mall have risen ½. British Westinghouse Pref. have again been picked up, and have risen ⅛ to over 1, while the Debentures are also better at 66½. Telegraph Construction improved to 38, which follows upon a rise last week. British Insulated and Helsby Cables have improved; but Babcock and Wilcox, after their recent advance, have reacted to 3½. At this week's plantation sales a record amount of rubber was put up, and, very naturally, the price fell still further. The depression has been accentuated by the fear that the trouble of an American firm is of a worse description than was originally suspected.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, August 27th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	2¾d.	..
a „ Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29 10	..
a Bleaching powder	„	£6 5	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£17 10	..
a Copper Sulphate	„	£21 10	..
a Lead, Nitrate	„	£27 10	..
a „ White Sugar	„	£26	..
a „ Peroxide	„	£32	..
c Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (88/90 %) ..	per ton	£22 10	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide (98/100 %) ..	„	7½d.	..
(for mining purposes only)			
a Shellac	per cwt.	100/-	15/- inc.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	„	£8 10	..
a „ Recovered	„	£5 10	..
a „ „ Lump	„	£5	..
a Soda, Caustic (white 70/72 %) ..	„	£10 5	..
a „ Chlorate	per lb.	3½d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£95	..
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	£121 6 8	..
b „ Sheet, in ton lots ..	„	£126	..
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	8¼d.	¼d. inc.
c „ Tube (brazed)	„	10⅝d.	⅛d. inc.
c „ „ (solid drawn)	„	9⅛d.	⅛d. inc.
c „ Wire, basis	„	8¼d.	¼d. inc.
c Copper Tubes (brazed)	„	11⅜d.	¼d. inc.
c „ „ (solid drawn)	„	11½d.	¼d. inc.
g „ Bars (best selected) ..	per ton	£86	£1 inc.
g „ Sheet	„	£86	£1 inc.
g „ Rod	„	£86	£1 inc.
d „ (Electrolytic) Bars ..	„	£73	..
d „ „ Sheets ..	„	£91	..
d „ „ Rods	„	£78 10	..
d „ „ H.C. Wire	per lb.	9½d.	..
f Ebonite Rod	„	4/6	..
f „ Sheet	„	4/-	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	6/6 to 7/6	dec.
h India-rubber, Para fine	„	3/9	1d. dec.
l Iron Pig (Cleveland warrants) ..	per ton	54/9	2d. dec.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£20 15 to £21	10/- dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bott.	£7 5	..
c Mica (in original cases) small ..	per lb.	6d. to 8s.	..
c „ „ „ medium	„	3/6 to 6/-	..
c „ „ „ large ..	„	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	„	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/0½ to 1/2	..
p „ „ rolled strip & sheet	„	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	11d.	1d. inc.
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£195 to £196	£2 inc.
n „ Wire, Nos. 1 to 16	per lb.	2/7	1d. inc.
p White Anti-friction Metals ..	per ton	£50 to £226	..
k Zinc, Sh's (Vieille Montagne bnd.)	„	£25 5	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p Bolling & Lowe.
r W. F. Dennis & Co.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Aug. 26th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bournemouth & Poole, Ord.	10	5½	6	9⅞ — 10¼ xd	..	5 17 1
Do. 4½ % Pref.	10	4½	4½	8¾ — 9¼ xd	..	4 14 9
Do. Second 6 % Pref.	10	6	6	9⅞ — 10⅜ xd	..	5 15 8
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 98	..	4 11 10
Brompton & Kensington, Ord.	5	10	10	8⅞ — 8⅞ xd	..	5 14 3
Do. 7 % Cum. Pref.	5	7	7	8⅛ — 8⅝ xd	..	4 1 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	94 — 97	..	4 2 6
Charing Cross, West End & City	5	5	5†	4⅞ — 4⅞ xd	..	5 2 7
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜ xd	..	4 17 3
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3¾ — 4	..	5 12 6
Do. Do. 4 % Deb.	100	4	4	90 — 92	..	4 7 0
Chelsea, Ord.	5	5	4†	4⅝ — 5⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	10	8	9	15 — 16	— ¼	5 12 6
Do. 8 % Cum. Pref.	10	6	6	12 — 13	..	4 12 4
Do. 5 % Deb.	Stock	5	5	114 —118	..	4 4 9
Do. 4½ % Second Deb.	100	4½	4½	99 —101	..	4 9 1
County of London, Ord.	10	6	6	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	11½ — 12½	+ ½	4 18 0
Do. 4½ % Deb.	Stock	4½	4½	102½ —104½	..	4 6 2
Do. 4½ % Second Deb.	Stock	4½	4½	98 —101	..	4 9 1
Edmundson's, Ord.	£3	Nil	..	3⅝ — 3⅞	..	Nil
Do. 6 % Cum. Pref.	5	Nil	6	4 — 4½	..	8 8 7
Do. 6% Non-Cum. Pref.	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	80 — 83	+1	5 8 5
Folkestone	5	6	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4½ — 5	..	5 0 0
Do. 4½ % First Deb.	100	4½	4½	88 — 90	..	5 0 0
Hove	5	9	9†	7⅞ — 8¼	..	5 9 1
Kensington & Knightsbridge, Ord	5	9	8†	7⅛ — 7⅝ xd	..	5 18 0
Do. 4 % Deb.	Stock	4	4	88 — 91	..	4 7 11
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	74 — 78	..	5 15 5
London Electric, Ord.	8	2½	2½	1½ — 1⅝	..	4 7 9
Do. 6 % Pref.	5	6	6	4⅝ — 5⅜	+ ⅛	5 11 7
Do. 4 % First Mort. Deb.	Stock	4	4	88 — 91	..	4 8 0
Metropolitan	5	4	4†	8¼ — 8⅝ xd	..	5 10 4
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4½	..	5 0 0
Do. 4½ % First Mort. Deb.	Stock	4½	4½	96 — 98	..	4 10 1
Do. 3½ % Mort. Deb.	Stock	3½	3½	77 — 80	..	4 7 6
North Metropolitan Power Supply, 6 % Mortgages (Red.)	100	5	5	98 —101	..	4 19 0
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9½ — 10½	..	5 14 3
Oxford	5	7½	6†	6 — 6½	..	5 11 6
St. James' and Pall Mall, Ord.	5	10	10†	8¾ — 9	+ ⅛	5 11 1
Do. 7 % Pref.	5	7	7	6⅜ — 7	..	5 0 0
Do. 3½ % Deb.	100	3½	3½	82½ — 85½	..	4 1 10
South London, Ord.	4	5	5½	2⅞ — 3⅛	..	7 0
Do. 5 % First Mort. Deb.	100	5	5	96 — 99	..	5 1 0
South Metropolitan, 7 % Pref.	1	7	7	1⅞ — 1⅞	..	5 17 11
Do. 4½ % First Deb. Stock	100	4½	4½	96 — 99	..	4 10 6
Urban, Ord.	£3	Nil	Nil	⅛ — ⅜	..	..
Do. 5 % Cum. Pref.	5	2	3	2⅜ — 2⅝	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	85 — 88	..	5 2 3
Westminster, Ord.	5	10	10	8½ — 8⅝ xd	+ ⅛	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 5½	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5 — 5½	..	5 14 3
Calcutta, Ord.	5	8½	8½	7 — 7½	..	5 13 4
Do. 5 % Pref.	5	5	5	5 — 5½	..	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	90½ — 92½	..	5 8 1
Canadian Gen. El. Com.	$100	7	7	113 —117	+5	5 19 8
Do. 7 % Pref.	$100	7	7	119 —124	..	5 12 11
Cordoba Lt., Power and T., Ord.	1	3	5	⅜ — 1⅜	..	6 8 1
Do. 5 % Deb.	100	5	5	93½ — 95½	..	5 4 9
Elec. Lt. and P. of Cochabamba, 8 % Bonds	100	8	8	90 — 92	..	6 10 5
Elec. Supply Victoria, 6 % 1st Mort. Deb.	100	5	5	87½ — 90½	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	91½ — 93½	..	5 6 11
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 — 3/16	..	Nil
Do. 6 % Pref.	1	6	6	5/8 — 5/16	— 1/16	10 13 4
Kaministiquia Power, 5 % G. Bs.	$500	5	5	101 —103	..	4 17 1
Madras, Ord.	5	Nil	..	1¼ — 1⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	103 —106	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	78 — 82	..	6 1 11
Mexican Lt. & Power, Common	$100	4	4†	64 — 68	—4	5 17 8
Do. 7 % Cum. Pref.	$100	7	7	95 —100	—1	7 0 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	90 — 92	..	5 8 8
Do. 5 % 2nd Mort. Bonds	100	5	5	79 — 81	—1	6 8 5
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	74 — 77	—2	6 9 10
Montreal, Lt., H. and Power	$100	8	9†	215 —225	..	4 0 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	10	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	102 —107	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	97½ — 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 8
Shawinigan Water, Capital	$100	5	5½	134 —139	..	3 19 2
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	104½—106½	..	4 14 0
Do. 4½ % Per. Deb.	Stock	4½	4½	99½—102½	..	4 7 10
Toronto Power, 4½ % Deb.	Do.	4½	4½	97 —100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	90½ — 92½	..	5 8 1
Victoria Falls Power, Pref.	1	11½d.	17½d.	11/16 — 13/16	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106 —108	..	5 11 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4½†	6⅞ — 7⅜	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	94 — 96	+ ½	5 2 2
American Telep. & Teleg., Cap.	$100	8	8	132 —135	..	5 18 6
Do. Collat. Trust	$1000	4	4	90 — 92	— ½	4 7 0
Anglo-American Telegraph	Stock	3	3	62 — 65	..	4 12 4
Do. 6 % Pref.	Do.	6	6	108 —109	..	5 10 1
Do. Def.	Do.	30/-	30/-	23¼ — 23⅝	— ½	6 6 4
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	104 —106	..	4 15 3
Chili Telephone	5	7	8	7⅝ — 7⅞	..	5 5 10
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	82½ — 84½	..	4 14 8
Cuba Telegraph	10	6	6	8½ — 9½	— ½	6 9 9
Do. 10 % Pref.	10	10	10	15½ — 16½	..	5 19 4
Direct Spanish Telegraph, Ord.	5	4	4†	8½ — 9⅜	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6⅜ — 7½	..	6 12 0
Direct United States Cable	10	5	4	6½ — 7½	..	5 10 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	127 —130	..	5 7 8
Do. 8½ % Pref. Stock	Do.	8½	8½	75 — 77	— ½	4 10 11
Do. 4 % Mort. Deb.	Do.	4	4	94½ — 96½	..	4 2 11
Eastern Extension	10	7	7	12½ — 13	..	5 7 8
Do. 4 % Deb.	Stock	4	4	92 — 94	..	4 5 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99 —101	..	3 19 3
Globe Telegraph and Trust	10	6	6†	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	19½ — 19⅝	+ ⅛	4 16 1
Great Northern Telegraph	10	18	20	30 — 32	..	6 13 0
Indo-European Telegraph	25	13	13	55½ — 57½	..	5 18 1
Mackay Companies Common	$100	5	5	82 — 84	..	5 19 1
Do. 4 % Cum. Pref.	$100	4	4	66 — 70	..	5 14 4
Marconi's Wireless Telegraph	1	20	..	4 — 4⅛	— 1/16	4 17 0
Do. 7% Cum. Partic. Pref.	1	17	..	8⅜ — 8⅝	— ⅛	4 17 2
Monte Video Telephone, Ord.	1	6	6†	1 — 1⅛	..	5 6 8
Do. 5 % Pref.	1	5	5	2/16 — 3/16	..	5 14 3
New York Telep., 4½% Gen. Bnds.	100	4½	4½	100 —101	+ ½	4 9 1
Oriental Telep. and Elec.	1	8	10	18⅜ — 18⅞	..	5 8 6
Do. 6 % Cum. Pref.	1	6	6	1⅜ — 1½	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	86½ — 88½	..	4 10 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96 — 98	..	4 1 8
Reuter's	10	10	10	9⅜ — 10½	..	9 17 6
Submarine Cables Trust	Cert.	6	6	124 —127	..	4 14 6
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 9
United River Plate Telephone	5	8	8†	6⅜ — 7	..	5 14 4
Do. 5 % Cum. Pref.	5	5	5	5 — 5⅛	..	4 11 0
West Coast of America	2½	2½	..	1 3/16 — 1 7/16	..	4 8 4
Do. 4 % Debs., 1 to 500 guar. by Bras. Sub. Tel.	100	4	4	93 — 96	..	4 1 8
West India and Panama Teleg.	10	1½	1½	2⅜ — 2⅞	— ⅛	4 6 11
Do. 6 % Cum. 1st Pref.	10	6	6	9⅜ — 10⅛	..	5 18 5
Do. 6 % Cum. 2nd Pref.	10	6	6	9⅜ — 9¾	..	6 1 6
Do. 5 % Debs.	100	5	5	99 —101	..	4 19 0
Western Telegraph, Ltd.	10	7	7†	12⅜ — 13½	..	5 5 8
Do. 4 % Deb.	Stock	4	4	90½ — 92½	..	4 6 6
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	93 — 95	..	4 14 9

* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 3s. in Funded Dividend Certs.

CONTINUED ON NEXT PAGE

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Aug. 26th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	* 1	Nil	Nil	5/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	3 7/16 — 3 5/8	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	72 — 77	..	5 17 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	10 — 11 1/8	+1/8	..
Do. Do. Deferred	100	..	..	4 1/8 — 6	+1/4	..
Do. Do. 6 % Cum. Pr'f	100	6	6	85 — 88	+5	6 16 4
Do. 7 % Non-Cum. Pr'f.	100	..	3	46 — 49	+3	6 2 5
Do. 5 % Perp. Deb.	100	5	5	90 — 93	..	5 7 6
Do. 4½ % 2nd Deb.	100	4½	4½	74 — 78	+2	5 15 5
Central London Railway, Ord.	100	3	3	73 — 75	..	4 0 0
Do. Gtd. Assented	100	..	..	81 — 83	..	4 16 5
Do. Pref.	100	4	4	76 — 78	—2	5 2 7
Do. Gtd. Assented	100	..	..	83 — 85	+1	4 14 2
Do. Def.	100	2	2	75 — 77	..	2 12 0
Do. Gtd. Assented	100	..	..	80 — 82	..	4 17 7
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	98 —100	..	5 0 0
Do. Do. 1896	100	5	5	98 —100	..	5 0 0
Do. Do. 1901	100	5	5	97 — 99	..	5 1 0
Do. Do. 1908	100	5	5	97 — 99	..	5 1 9
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2 1/16 — 2 3/8	..	Nil
Hastings Trams, 6 % Pref.	1	6	6†	17/32 — 25/32	..	7 13 7
Do. 4½ % Deb.	100	4½	4½	68 — 73	..	6 3 3
Isle of Thanet Trams, 5 % Pref.	5	2 1/8	2 1/8	2 1/16 — 2 3/8	..	4 15 3
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	76 — 78	..	6 8 2
London and Suburban, Ord.	1	..	..	1/16 — 3/16	..	..
Do. Do. 5 % Cum. Pref.	1	..	..	1/16 — 1/8	..	..
Do. Do. 4½ % 1st. Deb.	100	..	4½	65 — 75	..	6 0 0

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Aug. 26th.	Rise + or Fall —	Present Yield p.c. £ s. d.
London Elec. Railw'ys, 4 % Deb.	* 100		4	91 — 93	..	4 6 0
London United Trams, 4 % Deb.	100	4	4	60 — 64	..	6 5 0
Metropolitan Railway Consol.	100	17	18	48 — 48½	+ 3/4	3 7 0
Do. Surplus Lands	100	2 3/8	2 3/8	60 — 62	..	4 8 9
Do. 3½ % Deb.	100	3½	3½	83 — 85 xd	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	81 — 83 xd	..	4 4 4
Do. 3½ % Con. Pref.	100	3½	3½	77 — 79 xd	..	4 8 7
Metropolitan District Ord.	100	Nil	Nil	35 1/4 — 35 3/4	+ 3/4	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	82 — 84	..	5 7 2
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	84 — 88	..	5 2 3
Do. 5 % Deb.	100	5	5	90 — 93	..	5 7 6
Potteries, Ord.	1	4½	3½	3/8 — 13/32	..	..
Do. 5 % Pref.	1	6	5	31/32 — 1 1/32 xd	..	7 12 5
Do. 4½ % Deb.	100	4	4½	82 — 85	..	5 6 5
South Metro. Trams, 6 % Pref.	1	..	..	5/8 — 3/4	..	8 0 0
Do. 4 % Deb.	100	..	4	63 — 68	..	5 17 8
Underground Elec. Railways	10	..	3½	3 7/8 — 4 1/8	..	Nil
Do. "A"	1/-	4½	..	3/8 — 7/16	..	Nil
Do. 6% First Cum. Inc. Deb.	100	1½	6	112 —114	+1	5 5 3
Do. 4½ % Bonds	100	Nil	4½	99 —101	..	4 9 1
Do. 6 % Income	100	3	6 †	94 — 95½	+1	6 5 8
Yorkshire (West Riding), Ord.	5	..	..	5/8 — 11/16	..	Nil
Do. 6 % Pref.	5	..	3½	3 7/8 — 4	..	..
Do. 4½ % Deb.	100	4½	4½	81 — 85	..	5 6 0

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5 1/8	5 1/8	4 11/16 — 4 15/16	..	5 11 4
Do. 2nd Pref.	5	5 1/8	5 1/8	4 3/8 — 4 5/8	..	5 18 11
Do. 4 % Deb.	100	4	4	91 — 93	..	4 6 0
Do. 4½ % Deb.	100	4½	4½	95 1/4 — 97 1/2	+ 1/2	4 12 4
Do. 5 % Deb.	100	5	5	97 1/2 — 99 1/2	..	5 0 6
Auckland Trams, 5 % Deb.	100	5	5	100 —102	..	4 18 0
Bombay Elec. S. & Trams, Pref.	10	6	6	10 3/4 — 11 1/2	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	96 — 99	..	5 1 0
Brazilian Traction Light and Power	£100	..	6†	95 1/2 — 96 1/2	+1 1/2	6 4 8
risbane Trams Invt., Ord.	5	8	8	7 — 7 1/2	+ 1/8	5 6 8
Do. 5 % Pref.	5	5	5	4 3/4 — 5 1/8	..	4 8 11
Do. 4½ % Deb.	100	4½	4½	97 —100	..	4 10 0
B. Columbia Elec. Rly., Def.	100	8	8†	126 —131	+1	6 2 2
Do. Pref. Ord.	100	6	6	111 —116	+1	5 3 5
Do. 5 % Pref.	100	5	5	102 1/2 —105 1/2	..	4 14 9
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	100 —102	..	4 8 8
Do. 4½ % Con. Deb.	100	4½	4½	95 1/4 — 97 1/2	..	4 7 2
Calcutta Trams, Ord.	6	7	6†	5 7/8 — 6 1/8	..	5 12 0
Do. 5 % Pref.	5	5	5	4 3/8 — 5 1/8	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	95 1/2 — 98 1/2	..	4 11 5
Cape Electric Trams	1	2 1/2	5	1 1/16 — 1 1/8	..	6 8 1
City Buenos Aires Trams (1904)	5	5	5†	5 1/16 — 5 1/16 xd	..	4 9 11
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90 1/2 — 94 1/2	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94 1/2 — 98 1/2	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	6	3	25 — 35	..	..

La Plata Elec. Trms, Ord.	1	Nil	..	13/32 — 17/32	..	..
Do. Pref.	1	6	..	29/32 — 1 3/32	..	5 16 6
Lisbon Elec. Trams, Ord.	1	6	4½d.	1 3/32 — 1 5/32	..	4 9 8
Do. 6 % Pref.	1	6	6	1 — 1 1/8	..	4
Do. 5 % Deb.	100	5	5	91 — 96	..	5
Madras Elec. Tr. 6% Cum. Pref.	5	..	6	4 3/8 — 5 1/8	..	6
,, Elec. Tr. (1904), Deb.	100	5	5	101 —103	..	4 17
Manaos Trams & Lt., 1st Deb.	100	5	5	87 — 89	..	5 12
Manila Elec. R. and Lig., Bonds	$1000	5	5	97 — 99 xd	..	5 1
Mexico Trams Com.	$100	7	7†	97 — 99	—3	7 1
Do. Gen. Con. 5 % Bonds	..	5	5	92 1/2 — 94 1/2	—1	5 5
Do. 5 % Bonds	100	5	5	92 1/2 — 94 1/2	— 1/2	6 7 0
Para Elec. Rlys. & Lt., Ord.	5	10	10	6 3/8 — 6 5/8	+ 1/8	7 12 9
Do. 6 % Pref.	5	6	6	4 13/16 — 5 1/16	+ 1/16	5 15 8
Do. 5 % 1st Deb.	100	5	5	98 1/2 — 100 1/2	..	4 19 6
Perth (W.A.) Elec. Tr., Ord.	1	5	5 1/2	1 1/8 — 1 1/4	..	4 0 0
Rangoon El. Tr. & Sup., Pref.	5	8	8	5 — 5 1/2	..	5 9 1
Do. 4½ % 1st Deb.	100		4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..		5	101 —103	— 1/2	4 17 1
Do. 5 % Mort. Bonds	100	5	5	95 — 97	— 1/2	5 3 1
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	£500	5	5	102 — 104	+1	4 16 2
Singapore Trams, 5 % Deb.	100	5	5	85 — 89	..	5 12 4
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	—1/2	5 5 3
Un. Elec. Trams Monte Video	5	7	7	4 1/2 — 5	..	7 0 0
Do. 6 % Pref.	5	6	6	4 3/8 — 5 1/16	..	5 18 7
Do. 5 % 1st Deb.	100	5	5	97 —100	..	5 0 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	101 —103	+1	4 7 5

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	7/8 — 15/16	..	7 7 8
Do. 6 % Pref.	1	6	6	31/32 — 1	..	7 2 6
Babcock & Wilcox	1	28	16	3 3/16 — 3 5/16	—1/16	5 0 5
Do. Pref.	1	6	6	1 1/4 — 1 5/8	..	4 7 8
British Aluminium, Ord.	1	Nil	..	1 3/16 — 1 1/4	..	..
Do. 6 % Cum. Pref.	1	Nil	6	1 1/4 — 1 5/8	..	5 17 2
Do. 5 % Prior Lien Debs.	100	5	5	91 — 94	..	5 4 2
Do. Deb. Stk.	100	5	5	82 — 85	..	5 17 8
B.I. & Helsby Cables	5	10	10	7 3/4 — 8 1/4	+ 1/4	6 1 3
Do. Pref.	5	6	6	5 7/8 — 6 1/4	..	4 16 0
Do. Deb.	100	4½	4½	99 —102	..	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	95 — 98	..	4 11 10
British Westinghouse, Pref.	8	Nil	Nil	1 5/8 — 1 7/8	+ 1/8	Nil
Do. Deb.	100	4	4	65 — 68	+ 1/2	5 17 8
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	3/4 — 7/8	..	Nil
Do. Pref.	1	..	..	4/6 — 5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — 1/4	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	70 1/2 — 75 1/2	..	6 12 5
Do. 4½ % Deb.	100	4½	4½	88 — 48	..	10 9 4
Do. 4½ % Second Deb.	100	4½	4½	28 — 27	..	16 13 4
Callender's Cable	5	15	15	10 3/4 — 11 1/4	..	6 10 5
Do. Pref.	5	5	5	4 13/16 — 5 1/16	..	4 18 9
Do. Deb.	100	4½	4½	96 — 99	..	4 10 6
Casmer-Kellner	1	20	20	8 1/4 — 8 1/2	..	5 4 11
Do. Deb.	100	4½	4½	102 —105	..	4 5 9

Crompton & Co., Deb.	100	5	5	54 1/2 — 59 1/2	..	8 8 0
Dick, Kerr	1	5	Nil	5/8 — 3/4	..	..
Do. Pref.	1	6	6	31/32 — 1 1/32	..	7 13 10
Edison & Swan, A, £8 paid	5	Nil	..	0 — 1/8	..	Nil
Do. fully paid	5	Nil	..	1 1/4 — 1 1/2	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	65 — 70	..	7 2 10
Electric Construction	2	3/4	5	1 — 1 1/4	..	8 0 0
Do. Pref.	2	7	7	1 3/4 — 2 1/16	..	6 15 9
Greenwood & Batley, Pref.	10	7	7	7 1/2 — 8	..	8 5 8
Do. Deb.	100	5	6	92 — 94	..	5 4 2
General Electric, 6% Pref.	10	5	6	9 3/4 — 10 1/4	..	5 14 8
Do. Deb.	100	4	4	89 — 94	..	4 5 1
Henley's, Ord.	5	15	15	12 1/4 — 12 3/4	..	5 18 2
Do. Pref.	5	4 1/2	4 1/2	4 7/8 — 5 1/8	+ 1/8	4 7 10
Do. Deb.	100	4½	4½	100 —102	..	4 8 8
India-Rubber, G. & T.	10	..	7 1/2	12 3/4 — 13 1/4	..	5 9 1
Do. Pref.	10	5	5	9 3/4 — 10 1/4	+ 3/8	4 18 9
Telegraph Construction	12	17 1/2	20	37 — 39	+1	6 3 1
Do. Deb.	100	4	4	95 — 97	..	4 2 6
Willans & Robinson	1	Nil	..	1/4 — 3/8	..	Nil
Do. Pref.	5	Nil	..	1/2 — 3/4	..	Nil
Do. Deb.	100	4	4	55 — 57	..	7 0 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 4½ per cent., April 17th, 1913.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING JULY, 1913.

The returns of electrical exports and imports for July, which we publish below, show a considerable improvement on the figures of the previous month.

Thus the exports reached £660,363 in value, as against £499,995 recorded for June, the increased total, however, being traceable more particularly to a large telegraphic export to the United States. The imports for the month were valued at £217,415, which compares with £211,256 the total for June, while the re-exports reached the high total of £34,462, being some £8,000 in advance of the previous month's figure.

As regards the individual sections of the exports, the machinery total compared badly with the previous month, and the value of cable exports was only slightly in excess of the previous month's figures—in fact, the improved export total was solely due to activity in the telegraphic section.

The imports, on the other hand, showed small increases in value in several directions, and the only notable drop was in telegraphic and telephonic imports. Apart from the U.S.A., which, owing to the circumstance mentioned above, was our most prominent customer during the month, India, New South Wales and Argentina contributed substantial amounts to our export business, while as regards the importers to this country, the position remains substantially the same as in previous months.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,282	685	149	78	1,739	546	12,177	49	34	41	1,036	2,079	19,895
Germany	2,284	4,706	77	354	606	928	4,424	38	25	...	27	119	13,588
Netherlands, Java and Dutch Indies ...	695	979	294	75	...	1,071	1,022	19	7	12	33	17	4,224
Belgium	689	558	160	30	159	19	1,801	763	286	...	1,493	226	6,184
France	210	...	3,493	21	...	32	6,180	1,215	6	16	373	155	11,701
Portugal	159	21	26	...	...	...	363	...	8	18	316	31	941
Spain, Canary Isles and Spanish N. Africa...	1,420	644	215	...	470	...	4,735	66	19	2	583	307	8,461
Switzerland, Italy and Austria-Hungary ...	797	1,156	565	...	138	...	2,332	...	48	473	237	3,962	9,708
Greece and Turkey	197	107	305	...	...	...	476	...	98	...	6,896	3,007	11,086
Channel Isles, Gibraltar, Malta and Cyprus...	27	22	55	64	...	132	53	...	16	...	...	938	1,307
U.S.A., Philippines and Cuba	262	101	66	38	76	47	1,555	...	22	...	500	191,574	194,241
Canada and Newfoundland	419	2,832	793	792	...	1,804	15,333	87	693	...	2,170	903	25,826
British West Indies, British Honduras and British Guiana	372	...	303	22	23	43	225	...	42	...	71	192	1,293
Mexico and Central America	97	43	19	...	25	...	1,453	9	4	31	...	154	1,835
Peru and Uruguay	1,117	196	156	250	...	5	291	154	3	26	...	1,475	3,673
Chile	770	217	503	415	125	...	2,673	...	137	36	171	6,899	11,946
Brazil	2,714	1,161	701	427	11	792	6,892	684	255	23	609	11,930	26,199
Argentina	3,267	7,417	404	773	670	1,069	8,419	591	1,344	123	9,454	3,213	36,744
Colombia, Venezuela, Ecuador and Bolivia...	56	...	115	12	...	...	668	...	...	...	...	65	916
Egypt, North Africa and Persia	219	560	151	223	...	3	1,169	226	23	...	40	16,294	18,908
British West Africa	73	145	13	21	...	...	669	68	185	...	238	238	1,650
Rhodesia, O.R.C. and Transvaal	1,137	372	413	881	...	472	4,576	251	163	...	175	720	9,160
Cape of Good Hope	996	2,090	711	457	13	984	1,544	3,150	763	...	...	799	11,507
Natal	1,225	10,285	510	347	153	...	4,796	...	193	7	134	57	17,707
Zanzibar, Brit. E. Africa, Mauritius & Aden	443	179	37	77	...	33	849	...	33	...	136	844	2,631
Azores, Madeira and Portuguese Africa ...	426	414	34	74	36	86	3,922	99	78	...	108	1,389	6,666
French African Colonies	20	...	...	...	...	18	...	...	20	...	...	...	58
China and Siam	580	1,007	1,444	163	32	3,531	1,745	303	93	...	3,871	15,805	28,574
Japan and Korea	497	496	36	30	...	346	5,238	...	1,597	...	82	357	8,679
India	6,117	11,185	1,551	2,189	336	760	19,643	6,773	7,323	140	1,011	2,111	57,139
Ceylon	118	211	120	37	...	27	842	52	278	...	228	49	1,962
Straits Settlements, Fed. Malay States, Brit. North Borneo and Sarawak... ...	412	545	358	155	31	1,429	1,418	3,572	1,186	56	1,649	15,993	26,804
Hong Kong	825	955	106	51	...	...	1,830	8	210	...	43	427	4,455
West Australia	853	12	36	421	...	367	484	...	82	...	891	105	3,251
South Australia	617	707	202	164	...	19	2,728	15	88	3	50	74	4,667
Victoria	1,780	2,689	616	778	217	177	4,238	...	210	...	344	77	11,126
New South Wales	2,791	21,338	655	1,390	380	499	8,925	897	484	22	2,184	2,023	41,588
Queensland	220	12	54	385	103	25	614	...	71	...	13	...	1,497
Tasmania	74	295	...	...	...	1	93	...	...	...	...	...	463
New Zealand and Fiji Islands	1,478	1,315	639	107	134	706	2,333	...	455	13	2,472	2,451	12,103
Total, £	37,735	75,657	16,084	11,301	5,477	15,971	138,728	19,089	16,582	1,042	35,648	287,059	660,363

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	115	...	...	33	...	...	6,936	40	639	...	9,277	17,040
Germany	4,562	35,613	1,550	10,242	6,857	2,718	29,568	163	...	7,383	6,961	105,617
Holland	...	520	...	354	1,033	...	34	...	...	...	47	1,988
Belgium	854	2,094	35	272	162	20	2,940	40	512	...	4,840	11,769
France	1,170	...	731	774	177	231	210	...	642	4,097	1,048	9,080
Switzerland	291	1,014	40	...	...	379	1,368	...	...	15	42	3,149
Italy	...	3,218	...	...	...	...	...	...	...	...	164	3,382
Austria-Hungary	...	360	...	154	167	...	26	...	42	10	...	759
United States	6,352	632	2,158	55	181	78	15,400	34,389	577	790	3,512	64,124
Total, £	13,344	43,451	4,514	11,884	8,577	3,426	56,482	34,632	2,412	12,295	25,891	216,908

Additional imports: Spain, carbons, £367; Canada, electrical machinery, £140.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	18,935	853	...	2,533	957	...	7,323	...	728	1,659	1,474	34,462

Total Exports: £660,363. Total Re-Exports: £34,462. Total Imports: £217,415.

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

NEW FRENCH CAR-LIGHTING DYNAMOS.

The problem of producing a dynamo for motor-car electric lighting purposes that shall give not only a constant voltage, but also a constant output, notwithstanding the ever-varying speeds at which it may be driven, is one that is engaging the attention of electrical engineers both at home and abroad. Already several very efficient machines have been produced, but this does not prevent the introduction of

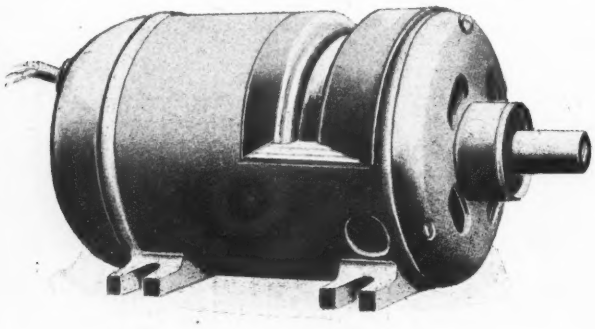


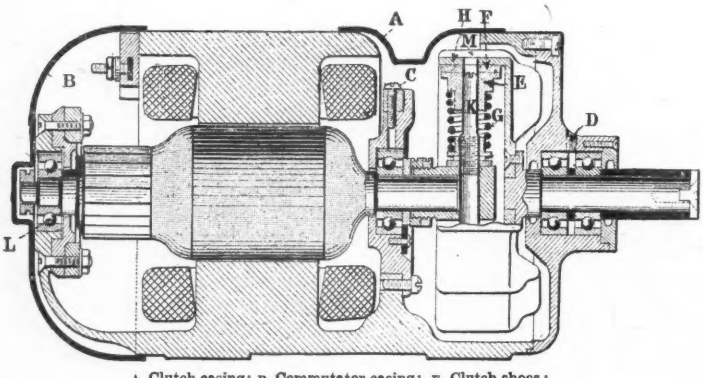
Fig. 1.—"Grada" Car-Lighting Dynamo.

new designs, and this week we propose to describe two interesting machines which have recently made their appearance in France.

The "Grada" dynamo, which is made by M. Perez, of 50, Rue de Paradis, Paris, possesses a bi-polar field, built up with an aluminium casing which encloses all the various parts. Between the poles rotates the usual armature, having at one end the collector and brushes, and at the other a clutch. It is the provision of the latter which forms one of the main features of the Grada system, for by its means a constant voltage is assured by arranging for a constant speed of the dynamo—about 1,200 r.p.m.—although the shaft which drives it may be running at anything from 2,000 to 3,000 r.p.m. It will be seen from the longitudinal section (fig. 2) that in addition to the armature spindle, a second spindle is provided at one end, this being driven by any suitable means off the engine of the car. On the second spindle is keyed a steel drum—marked A in the transverse section, fig. 3—so that the two rotate together. Connected with the armature spindle are two male clutch sections or shoes E, held in position by guides, and in contact with the inner face of the drum by the spiral springs B. Two weights D are also mounted on the armature spindle, they being connected by the links F to the clutch shoes. As the speed of the armature increases, the weights, by centrifugal action, tend to move away from the spindle, this movement being transmitted through the links F to the clutch shoes, which, as the pressure of the springs is overcome, become disengaged from the drum A.

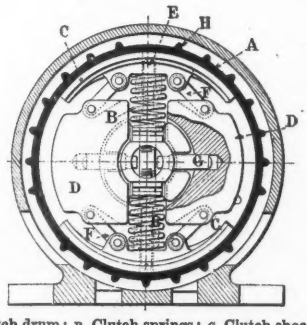
When the engine of the car is at rest, full contact is made between the drum and the shoes, so that when the engine is set in motion, the drum and, consequently, the armature, are caused to rotate. As soon as the speed increases, the pressure of the springs, counterbalanced by the effort transmitted by the links F, is reduced, and when the drum has attained a speed in excess of that for which the clutch is adjusted, the contact between the drum and the clutch shoes is broken, this taking place, as already mentioned, at a speed of about 1,200 r.p.m. The speed of the armature then diminishes until the centrifugal force of the weights becomes less than the strength of the springs, when contact between the drum and the shoes is again made.

In practice, the drive through the clutch is practically constant, a degree of slip taking place, varying in accordance with the speed of the engine. One of the Grada machines was recently submitted to two hours' test at the laboratory of the French Automobile Club at Levallois, near Paris, when the speed of the engine ranged from 464 to 1,371 r.p.m., and that of the clutch shaft from 1,302 to 4,114 r.p.m. Notwithstanding this wide variation, the speed of the armature spindle only fluctuated between 1,198 and 1,332 r.p.m., the voltage between 6·4 and 7·2, and the amperage between 7·9 and 8·5. Except for the blowing of a fuse near the close of the test, the lowest speed of the dynamo recorded would have been 1,248 r.p.m., the minimum voltage 6·7, and the lowest output 8·1 amperes. The tests were made directly, that is, without the intervention of a battery, and the report states that no heating of the dynamo was observed. It may be added that the face of the clutch shoes is lined with special material, which permits the clutch to be run dry, without danger of seizing or firing. With the object of keeping the clutch drum as cool as possible, its exterior face is provided with vanes H (fig. 3) which cause it to act as a fan.



A, Clutch casing; B, Commutator casing; E, Clutch shoes; G, Clutch springs; H, Clutch drum; M, Vanes of drum.

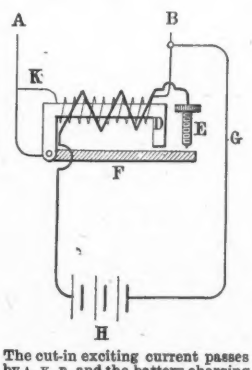
Fig. 2.—Sectional Elevation of "Grada" Dynamo.



A, Clutch drum; B, Clutch springs; C, Clutch shoes; D, Weights; F, Links; H, Clutch drum vanes.

Fig. 3.—Transverse Section of "Grada" Dynamo.

In a shunt-wound machine running at a constant speed, when the output of the machine is increased, the voltage at the terminals falls.



The cut-in exciting current passes by A, K, B, and the battery charging current by A, F, E, H, G, B, when the cut-in is engaged.

Fig. 4.—Diagram of Automatic Switch.

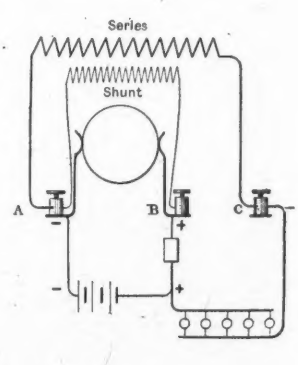


Fig. 5.—Diagram of Connections.

By using a compound winding, however, it is possible to obtain a uniform voltage, notwithstanding the varying amperage. This is the plan followed in the Grada dynamo, the arrangement being shown diagrammatically in fig. 5. The result is that, whatever the number of lamps in use, the brilliancy—which depends on the voltage—of each remains the same, and this without the assistance of the battery. In fact, if the engine ran continuously and at a sufficiently high speed the battery could be dispensed with, but as these conditions do not exist in automobile work, a set of accumulators is used.

The battery employed in the Grada system consists of three cells, having a total capacity of 60 ampere-hours, at a discharge rate of 8 amperes, or sufficient to run the whole of the lamps of a car for a period of 7½ hours. In use, however, the battery is always kept fully charged, for when the dynamo is running, its capacity is sufficient not only to run all the lamps, but also to give a slight charge to the accumulators. As regards overcharging the battery, it is well known that the voltage of a cell rises very quickly to 1·8 volts, and then very slowly to 2·2, finally making a quick rise to 2·5 volts. For a battery of three cells, the pressure at the approach of the period of overcharge is, therefore, 7·5 volts. From the figures relating to the tests already mentioned, it will be seen that the voltage of the dynamo never exceeds 7·2, so that there is no danger to be feared in this regard.

Passing now to the automatic cut-in and cut-out device, this, as will be seen, is not called upon to perform any function in preventing overcharge of the battery, but serves merely to prevent the accumulators discharging themselves through the dynamo, when the speed of the latter falls, and its voltage becomes less than that of the battery. The cut-in device, which is shown diagrammatically in fig. 4, consists merely of a bar of soft iron wound with fine wire, and placed in shunt to the terminals of the dynamo. When the voltage at the terminals becomes greater than that of the battery, the soft iron armature is attracted and closes the circuit. If, however, the speed of the engine varies considerably at about the number of revolutions at which the cut-in device works, the result will be a constant cutting in and out of the battery, accompanied by the usual sparking. To overcome this difficulty, the apparatus, in addition to the shunt winding already referred to, is also provided with a second winding of thick wire arranged in series with the battery-charging current. On open circuit,

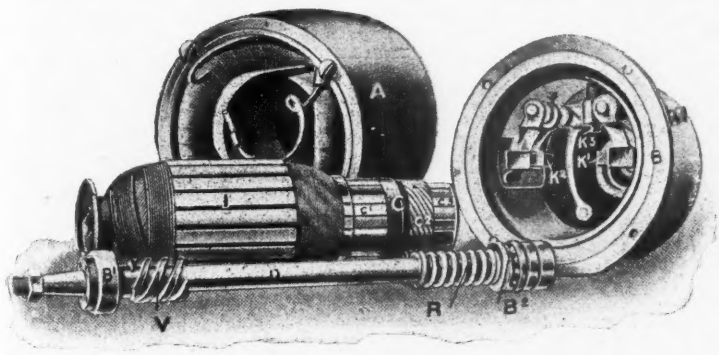


Fig. 6.—Details of "Stereos" Car-Lighting Dynamo.

the current passes through the shunt winding, but as soon as the cut-in device has closed, current passes in the same direction through the series winding, increasing the magnetism of the core. The cutting-out operation is, therefore, effected at a voltage less than that which brings about the cut-in. In other words, if the cut-in operates at a difference of potential of 7 volts, the battery will only be disconnected when the difference falls to 6·5 volts.

In the "Stereos" machine made by the Société des Etablissements Stereos, of 18, Rue Guersant, Paris, the problem has been attacked in quite another manner, neither centrifugal governor nor clutch nor automatic cut-out being employed. Reference to fig. 6 will show that the machine consists of a round shell or casing, on the inside of which are fixed the exciting coils, the shell being closed by end pieces which carry the bearings and the carbon brushes. The armature I, instead of being fixed to its spindle, as usual, is mounted thereon in such a way that while it must rotate with it, the relative position of the two, as the speed increases, is varied by means of the worm threads V cut on one end of the spindle. A light spring R maintains the armature close up to the driving end of the spindle when the dynamo is not being driven.

Another feature of the arrangement is that the collector is divided into four sections, the object of which is described below. The brushes K_1, K_2 convey the current to the battery of accumulators in the usual way, while a small

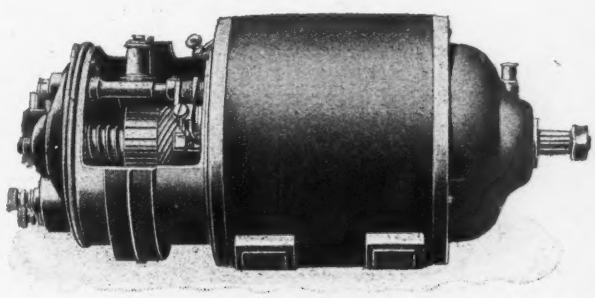


Fig. 7.—"Stereos" Dynamo, with Cover removed to show Commutator and Brushes.

vertical brush K_3 is also provided to pick up the exciting current and convey it to the field coils.

In action, when the engine is started up, and is running slowly, the brushes rest on an insulating ring C; no current is then taken off the machine, there being, in fact, no connection between the dynamo and the battery. As soon as the engine of the car attains its normal speed, the armature, under the influence of the increased speed, tends to move to the left away from the driving end of its spindle. The brushes then come in contact with the commutator strips C_1, and the exciting brush with the oblique strips C_2, connection with the battery and with the field coils being thus established. The oblique strips connect the two parts of the commutator C_1, C_3, which are identical except that the bars of the latter are set slightly out of line with those of C_1. When, due to the acceleration, the small brush K_3 is at the front end of the oblique strips, a maximum degree of excitation is attained, enabling the dynamo to produce its maximum output. As the speed increases, the armature continues its movement to the left, but any increase in voltage is prevented by the small brush coming in contact with the more oblique part of the strips, so bringing about a reduced excitation proportionate to the speed. This reduction of excitation has been carefully designed with the view of securing a constant voltage.

When the engine of the car slows down, or is stopped, the difference of potential between the battery and the dynamo converts the latter into a motor; the armature is then displaced to the right until, when the main brushes pass on to the insulating ring C, the connection between the battery and the dynamo is broken, the arrangement thus fulfilling the function of a cut-out in preventing the accumulators from discharging themselves through the dynamo.

Another feature of the machine may be mentioned: the exciting brush is arranged to slide in its support, so that it is possible so to set it, that the moment of its contact with the oblique strips C_2 shall be such as to furnish the necessary current required for any particular battery.

CENTRAL STATION ADVERTISING.

FROM A VETERAN PIONEER.

It is gratifying to learn from the leaderette in your issue of August 15th that there are signs that the managers of central electric supply stations are becoming keenly alive to the fact that there is a commercial side to their business. However perfect may be the arrangements for supplying the electricity, unless the public can be induced to use it, all the inventive engineering and financial skill available will not suffice for making the enterprise successful. If the time arrives, as it may do some day, when electric light and power is supplied, like wireless telegraphy, without the aid of coal, oil, or water-falls, high or low-tension cables, every one able to supply themselves direct from the ether, there will still be the necessity for commercial management in pushing business.

Having had nearly forty years' experience on the commercial side of the electrical industry, including the supply of many towns from central stations, I am familiar with the difficulties that attended the introduction of the new system; in the present day, it is mere child's play in comparison with the early efforts of those who had to deal with inefficient materials, as well as with the prejudices and conservatism of so large a portion of the community.

When I was engaged in supplying electricity to the only town under powers obtained through the Electric Lighting Act of 1882, I had to contend against many initial difficulties. The electric light was becoming known through experimental street lighting, exhibitions, public buildings, factories, places of amusement, &c., but in the case I refer to, it was the first attempt to supply in a town, from a central station, by means of underground mains, and following the ordinary conditions of the existing gas supply.

The first difficulty was to fix the terms of supply, and to prove that the electric light was in all respects superior to any other means of illumination. In one case I satisfied a pioneer consumer by agreeing to light his shop at a fixed sum per annum, based upon what he had paid in the previous year for gas, giving him all the benefit of the indirect economies arising from cleanliness, facility of lighting and extinguishing, &c., and I think that in the present day, when the metallic-filament lamps consume so little current, the same system would be worth testing. It would dispose at once of the question whether light for light electricity is cheaper than gas, as I have proved by the testimony of consumers in every town I have supplied, but which is even now disputed by some managing electrical engineers.

The charge for electricity, like that for gas, necessarily varies with local conditions—the price of coal, for instance, being the important factor—so that price must be based upon working out in each locality how the charge for gas compares with the proposed tariff for electricity, the advantages of health, safety, cleanliness, &c., being important points for use in canvassing.

In dealing with the Publicity Department, I have found that the most successful appeals are in the form of testimonials from consumers, who can speak from their personal experience, which should be published periodically in local pamphlets and circulated to the residents on the line of mains.

The ordinary canvasser, when listened to, is looked upon as an interested party, and his appeals and recommendations are received *cum grano salis*, but the testimony of a neighbour is quite another matter—the satisfied consumer being the best canvasser. Circulating the ordinary printed matter which is furnished for general distribution is of very little value in adding to the number of consumers.

There are two classes to consider, viz., those whose premises are situate on the line of mains, and the residents where no mains have been laid. I only remember one town (Weybridge) where the mains of the electric supply company are laid throughout the town, and I found in that case the number of consumers on the mains in proportion to the residents was greater than in a number of other towns where the mains were only laid in certain localities.

Of course the gas companies, whose mains, as a rule, are laid throughout the towns, have a great advantage over the electric companies, which are only prepared to supply certain localities, and this not only concerns the individual residents, but especially the street lighting.

The local pamphlets should contain not only testimonials but all matters of interest connected with the supply of electricity, and I have found especially useful a table showing the actual cost of the lighting quarter by quarter, and for the whole year, under the maximum-demand system, showing the advantage obtained by the long-hour consumer, and how the method of charge works out under varieties of use, the figures being taken from the consumers' accounts. Forms of the contracts for supply of energy, and local information bearing upon the business of the company, should be included, and these pamphlets circulated among all residents on the line of mains are of great value as business getters.

Every supply company should have showrooms in one of the leading streets of the town, where lamps, fittings, fans, cooking utensils, electric irons, &c., should be displayed, and price lists should be sent with the quarterly accounts to the customers of the company.

In addition to the local pamphlets intended for residents on the line of mains, it is useful to issue a monthly magazine to educate the public in the progress of the industry, which should circulate throughout the country, with a view to the creation of a general interest in the industry. In this magazine, not only should the advantages of adopting electricity be kept well to the front, but also the costliness, dangers, unhealthiness, inconvenience, dirtiness and extravagance of using gas, oil, candles, &c., should be illustrated by reports of the accidents constantly occurring from explosions, fires, suffocation, &c.

The local newspaper should be a valuable aid in pushing the business of the central station, not through the advertisement columns only, but in the publication of news relating to the progress of the undertaking, with which the general manager should keep the editor constantly supplied.

The contracts for street lighting should be obtained where possible, and in this matter the arrangement made by the local authority of the Metropolitan Borough of Holborn is of especial interest. In the case of Holborn, a joint contract by the electric lighting and the gas company has been carried out, the leading thoroughfares being lighted by electricity and the side streets by gas.

Arrangements of this kind would be convenient especially in towns where the electric company's mains were laid only in the principal streets.

THE ELECTRICAL WORK AT THE PHYSIKALISCH-TECHNISCHE REICHSANSTALT, CHARLOTTENBURG, IN 1912.

By EDWARD S. HODGSON.

This institution continues to report considerable progress both in routine test work and in research of importance to the electrical industry. The following notes give information as to the more interesting investigations carried out, for fuller details of which readers are referred to the annual report.*

During the year, the Reichsanstalt constructed a second set of standard air condensers on the model of those described in the last report, the individual parts being made up of aluminium or nickel-aluminium castings intead of the brass and gunmetal castings employed previously, thus keeping down the weight.

Fused quartz insulation was used in place of amber: this renders it possible to age the condensers artificially by heating, and quartz has the advantage of being uninfluenced by temperature changes.

A simple method was devised for testing the phase-angle of high-capacity decade resistance sets. For this purpose a liquid resistance of Mannit-boracic acid solution was used as the comparing resistance, the angle of this resistance being infinitely small. The measurement was carried out on an equal-arm, absolutely symmetrically-built bridge arrangement in which all disturbances from earth-capacities and mutual induction of the individual bridge arms were obviated.

* See *Zeitschrift für Instrumentenkunde*, for March, April and May, 1913.

The measurement of the 1,000-ohm coils of a bifilar resistance set wound by the Chaperon method, and their combinations with smaller resistances, showed that simple relations exist as regards the phase-angles, and thus they can be determined for the whole set by comparatively few measurements. A paper dealing with the subject is in print.

In connection with the increasing use of platinum resistance thermometers and the interest that this subject possesses for manufacturers of such thermometers, mention may be made of some measurements (now concluded) on the comparison of platinum resistance thermometers with the hydrogen thermometer between 0° and −190° C. Since over this range the resistance of platinum is a somewhat complicated function of the temperature, thermostats were constructed capable of maintaining constant any temperature between 0° and −150° C. A large number of comparisons were carried out, the absolute accuracy of the gas thermometer measurements attaining at least 0·04° C. Four platinum resistance thermometers compared with the hydrogen thermometer yielded values agreeing within 0·1 per cent. for the relation $R = r/r_0$, r and r_0 being the resistances at the temperatures $t°$ and 0°. Callendar's quadratic relation between resistance and temperature was proved to be valid to −40° C., yielding too-low temperatures below this range. With the four platinum thermometers mentioned above others were compared, the latter being made of older and less pure platinum. It was found that the quantities R of the individual thermometers at low temperatures differed from each other the greater the difference in their mean (measured) temperature coefficient a, where $a = (r_{100} - r_0)/100\ r_0$. For comparing various thermometers with each other, the relation $(t'_p - t_p) = ct_p\ (t_p - 100)$ was established between their observed platinum temperatures. This relation satisfies the condition that at 0° and 100° C. the platinum temperatures of all thermometers are in agreement. c is a constant which must be determined by experiment. From the foregoing equation we get for the difference $R' - R$ of the resistance ratios of two platinum thermometers, the expression—

$$R' - R = A\,(R - 1) + B = a'\,c/a^2.$$

By writing

$$A = a'\,(1 - 100c)/a - 1, \text{ and } B = a\,c/a^2,$$

this relation enables a calibration table for any platinum thermometer compared with another at only one temperature to be drawn up after the former has been thoroughly calibrated.

The Reichsanstalt has again actively co-operated with the German Society of Electrical Engineers and the Electrotechnical Society. At the instigation of the sub-committee on insulating materials, the Reichsanstalt has worked out, as the result of experiments, a simplified method for testing insulating materials at 750 volts, in which only the surface resistance under different conditions is determined. A number of firms have already requested the Reichsanstalt to test their insulating materials in this manner.

In determining the dielectric constants of solid insulators—such as porcelain, &c.—sent to the Institution in the form of plane parallel disks, it was found that the most usual method, and also the most convenient, of determining the dielectric constants from the difference in capacity of a double-plate condenser before and after inserting the insulating disk left much to be desired. The resultant errors are attributable to neglecting the "edge" correction and the capacity to earth. The three-plate condenser with earthed outer coating is preferable to the two-plate condenser for determining the dielectric constants of solids, since the capacity of the former is independent of the surroundings, and is thus clearly defined. A formula has been derived and experimentally verified for calculating the capacity of the three-plate condenser having plates of any thickness. The results of these experiments have been published.

A short account is given of a magnetic potentiometer, which will be useful in the magnetic testing of materials, and a paper is in preparation showing how the instrument may be used for testing the magnetic circuit of electrical machines. In connection with last year's experiments on electrolytic valvular action, the electrochemical behaviour of iron in sulphuric acid was investigated, with the following result. Iron shows in sulphuric acid both passivity and valvular action. With acid concentration of below 50 per cent., passivity only is present. From 60 per cent. onwards valvular action takes place before passivity when the iron is submitted anodically to a current of 3 milliamperes per sq. cm.; this valvular effect is, however, unstable up to a sulphuric acid concentration of 75 per cent. and changes to passivity when kept in circuit for some time. With higher concentrations, however, the valvular action persists. The maximum voltage is between 40 and 70 volts, according to the concentration of the sulphuric acid. Below the maximum voltage only a very small residual current flows through the cell. In concentrated and in fuming sulphuric acid, iron rectifies alternating current. The phenomena are the same as with aluminium. Nickel and cobalt behave like iron, while the following also show valvular action and rectification of alternating current: aluminium, tantalum, magnesium, cadmium, zinc, antimony, bismuth, copper and tin.

From experiments made at the Reichsanstalt, the following arrangement—a variation of that used by the Bureau of Standards—seems to afford a means of protecting shellacked wire resistances from the influence of moisture. The device can be fitted to resistance boxes as well as to single resistances. The wire coil, wound in the usual manner on a core tube, is inserted in a closely fitting thin-walled brass shielding tube; the space between core tube and protecting tube is closed off at the lower end by a brass ring, and at the upper end by an ebonite ring having two fine holes for the leads to the wire coil. The air-tight sealing is experimentally effected at the lower end, either by soldering or by coating with shellac, and at the upper end by covering the annular channel remaining above the ebonite ring with shellac or paraffin wax. As paraffin wax dissolves in petroleum, it is advisable to run shellac over it. The 1,000-ohm coils previously tested are packed with shellac, and not with paraffin wax. A table is given showing that no influence due to moisture was traceable.

In connection with magnetic sheet-iron, it was noted that the consignees invariably found the iron to be of poorer magnetic quality than did the consignors, and this led to the supposition that the gradual change in the magnetic qualities of such material due simply to storing might be considerably accelerated by the action of shaking arising from transit by rail. The Reichsanstalt has carried out tests—not yet concluded—which clearly show an influence due to the cause mentioned.

The method used for testing A.C. motor meters has been investigated with a view to determining the influence of upper harmonics on the calibration. The experiments made show the higher harmonics to exert but very slight influence.

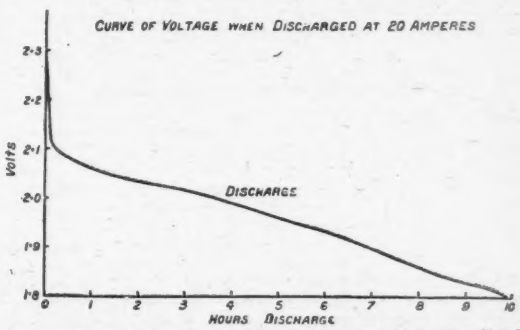
As regards the photometric work, it is stated that carbon filament lamps were not tested for life during the past year, but only metal-filament lamps, and practically only those having drawn filaments. Among the metal-filament lamps were four of special construction. In these lamps the filaments were not, as is usually the case, nearly parallel to the lamp axis, but arranged in one and two planes perpendicular to the lamp axis respectively.

Twelve lamps were sent from the National Physical Laboratory, Teddington, for international comparisons. They were measured in the prescribed direction, and at two voltages (1) at normal pressure, and (2) at so low a pressure as to give a light equal to the colour of normally burning carbon filament-lamps. Agreement to within 0·2 per cent. between the measurements of the Reichsanstalt and the National Physical Laboratory was obtained for the lower pressure, and to within 0·4 per cent. for the higher. Unfortunately, the filaments of the lamps were arranged about the lamp axis, as in the ordinary metal-filament lamps; the measurements would have been more reliable had the filaments been arranged in one plane. The lamps were sent on from the Reichsanstalt to the Laboratoire Central, in Paris.

The usual appendix containing a list of the papers published during the year is given, to which reference should be made for further information on experiments completed.

THE FULLER BLOCK ACCUMULATOR.

The Fuller block accumulators, which we described in our issue of August 30th, 1912, are a comparatively recent introduction, but they have now been in use for a sufficient length of time to prove that they possess qualities which call for special notice and commendation. The defects under which ordinary plate accumulators labour are well known, the tendency to buckle, and the liability of the active material to drop out, being two of the most noticeable. In the Fuller accumulator the plate form has been discarded, and what is practically the strongest form with



Overall dimensions of cell 18" × 7" × 11·5"; weight when filled with acid 97 lb.

N.P.L. Tests of Train Lighting Fuller Accumulator.

plane surfaces, namely, the triangular, has been adopted. An assemblage of blocks of this triangular form (like a sliced cake) forms the cell. Around each of these "slices" is wrapped glass wool (which is practically imperishable), and the slices so covered are separated from each other by corrugated celluloid separators, so as to allow free circulation of the acid solution. Although in this arrangement the outside surfaces of the assembled blocks are inactive, and therefore weight for weight the arrangement would apparently be much less efficient than the plate form, yet in actual practice this does not appear to be the case, there being little difference between the relative efficiencies of the new and old types. One result of the arrangement of the Fuller block accumulator—not an intentional one—is that the resistance of the cells is higher than that of the plate form, but this resistance is not so high as to be of consequence, whilst it has a very great advantage in that it prevents damage to the cells if they are accidentally short circuited; indeed, they will stand prolonged dead "shorts," even for hours at a time, without injury.

In regard to "sulphating" the record of the block accumulator is remarkable. The cell can be charged and left standing idle for 12 months, with no fear of sulphate forming or of the voltage

falling, and this although the cell has been partially discharged before being allowed to rest, a condition which ordinary accumulators will not stand, as is well known. The explanation of this property of the cells is said to be due to the fact that there is in the mass of material, and especially near the central core, a large amount of active peroxide which remains unaltered during discharge, even when the cell is discharged to 1·8 volts. As soon as the discharge is arrested, however, this latent energy in the cell immediately raises the voltage of the elements until the cell rapidly recovers to its full voltage, so that with an apparently discharged battery even a few minutes will show fair recovery, and on a voltage test it will appear to be almost fully charged. It is this recovery in voltage, owing to the cell in reality only being partially discharged, that prevents the chemical process known as "sulphation." This explanation seems reasonable and is a corollary of the fact that the amount of active material in the cells is exceptionally large.

Not only does the construction of the blocks ensure great rigidity, but their tight glass wool covering renders disintegration practically impossible, as even if flaking of the material were to take place the flakes could not fall away and cause short circuiting, and the deposit of mud at the bottom of the cells, so common in ordinary accumulators after long use, cannot take place.

It is satisfactory to note that no extravagant claims are put forward by Messrs. Fuller for their accumulators, which, indeed, if weight for weight they were markedly less efficient than the ordinary type, would still be, from their strong mechanical construction and durability, a very useful type indeed. Personal experience has proved, however, that such claims as are made are quite borne out by facts.

The results of tests made at the National Physical Laboratory are shown by the figure on p. 357 ; it should be mentioned, however, that although the height of the cell is given as 18 in., the actual height of the blocks themselves is but 7¾ in. ; the 18 in. height is really unnecessarily great, and must not be taken as an important dimension in comparing the block accumulator with others of the plate type in which the cells are smaller. Strict comparison between accumulators or batteries of widely different makes is not an easy matter, and great care has to be exercised to prevent either undue exaltation or undue depreciation of the various types for which certain claims are made.—H. R. K.

AMERICAN INSULATOR MANUFACTURE.

Twenty years ago people engaged in pottery manufacture in the United States used to look to England for their high grade clays, and it must be acknowledged that the enormous hills of comparatively pure clay or kaolin in England give it a natural advantage over the native producer, both as to quality and cheapness of production, but American push and ingenuity has given to the trade North Carolina and Georgia kaolins second to none in colour. In Florida, clay under water has been mined which was 75 per cent. sand, the clay has been separated from the sand, and the trade has obtained a clay which gives the colour of a china clay and the strength of a ball clay. It is these last qualities that appeal to the electrical porcelain manufacturers, as it gives them a strong piece of ware before and after burning without sacrificing the colour.

The Florida clays are mined by dredges under water or by other hydraulic methods, and clay, sand and water is sucked up through long lengths of pipe by means of big centrifugal pumps. The sand is settled out by means of various contrivances, while the clay is kept in suspension in the water. The clay and water is then run into settling tanks, where the clay settles and the clear water is drawn off. This leaves the clay about the consistency of very thick cream, and in this shape it is pumped by slip pumps into filter presses where the remainder of the water is forced out, and the cakes of clay are then taken from the filter presses and put upon racks of galvanised steam pipes to dry. The North Carolina and Georgia clays, are mined either in open cuts or from pits and shafts with pick and shovel, and then thrown into agitators or disintegrators where water is added, and then the process is practically the same as in the case of the Florida clay. The use of the filter press has done away with the necessity of the old evaporation tank largely used in England, which covers a great deal of space and is a very slow method of securing the clay in quantity and also gives opportunity for impurities from the air to get mixed into the clay.

Blunging.—When the clays are received the manufacturer first determines the percentage of moisture they contain. Knowing this, he proceeds to make up a mix consisting of the several kinds of clay, each in its proper proportion, and after adding the required amount of water, the mix is ready for the blunging process. The blunger is a tank-like machine, in the centre of which is provided a rotating member supplied with heavy blades for breaking up the lumps of clay and thoroughly mixing all the constituents to the consistency of very thin mud. In some factories a horizontal revolving steel cylinder containing the mix and heavy balls for grinding the clay, takes the place of the blunger. This machine is called a ball mill.

When the blunger or ball mill has ground the lumps all out of the mix, a valve in the bottom is opened and the mix is allowed to run out and through a very fine mesh copper lawn or screen into a pit under the floor of the room called an agitator.

Agitating.—The agitator is somewhat similar to, but very much larger than, the blunger. Its office is to keep the slip, as the mix is now called, in constant motion so that the clay will not settle to the bottom.

Pressing.—From the agitator the slip is pumped by means of high-pressure pumps into a press consisting of a framework holding about 50 iron disks or leaves so shaped that when pressed together by means of the screw at the end of the press, a disk-like cavity remains between each two leaves. Each leaf is provided with a hole in the centre, and also a canvas sack consisting of two pieces, one each side of, and the same size as, the leaf, each with a hole in the centre, the two pieces of canvas being sewed together around the circumference of the hole. When the disks are pressed together with these sacks between them, the slip is pumped in, and as the press fills up, the pressure rises and the superfluous water strains out through the canvas, leaving behind disks of moist clay, which can be removed when the press is opened.

After being taken from the press, the moist clay is put away in cellars and allowed to "age." This process takes from a day in some cases to several days in others, depending on the quality of the mix and nature of the ware to be made, but more particularly on the judgment of the foreman in charge of clay making. When the clay is taken from the ageing cellars it is ready for pugging.

Pugging.—The pug mill consists of a vertical cast cylinder, in the centre of which is a revolving member provided with projections similar to one of the blades of a boat propeller, and so arranged that when the clay is thrown into the open top of the mill it is constantly being worked or kneaded by these blades, and at the same time forced to the bottom of the mill. At the bottom, and on the side of the mill is provided a circular hole, through which the clay is forced. The cylinder of clay gradually being squeezed through the opening, is cut off into convenient lengths and is carried away to be made into ware.

Jollying.—The process of shaping the clay into the various forms is called jollying.

Moulds of plaster of paris having been previously made from prints or models, one of these is filled with the soft plaster clay and placed on the potter's wheel, which consists of a large drum fastened to the top of a vertical shaft. The wheel is caused to revolve, and the operator works the clay, using a sponge and a little water, into the shape of the "shoe" which forms the inside shape of the piece, the mould being made so as to form the outside shape. The arm carrying the shoe may be hinged at a point at one side of the wheel, or it may run on a guide vertically, counterbalanced by a weight, in which case the device is called a "pull down."

All high-voltage insulator parts are made in this manner, excepting the very small sizes. These are generally made in a machine so constructed that the mould is stationary. The shoe in this case is a revolving plunger, and operated through a split nut, having a thread of proper pitch, so that the plunger carrying a threader on its end will descend into the mould and thread the insulator at the same time as it forms the inside shape.

Drying.—As each mould is taken from the wheel it is placed in a hot room, where the drying of the piece begins. As soon as the piece has dried enough to cause sufficient shrinkage, the piece is taken from the mould, and the latter is ready to be used again.

In order to put through a large order for four-part insulators, at least 200 moulds for each part are necessary. It is, therefore, easily seen that the mould cost is an item of considerable importance in making up the ultimate price of the piece.

Finishing and Grooving.—When the piece approaches a state which may be called bone dry, the parts that were next to the mould have to be finished to remove surface or lap cracks made when the wad of clay was first put into the mould. This is done by mounting the piece on a revolving wheel and scraping the surface, then finishing with sand-paper. The grooving of the parts to be in contact with cement, and the turning of the side wire groove are also done at this time.

Glazing.—White glaze is made up of the same materials as the body with an extra quantity of flux, *i.e.*, feldspar. Brown glaze is simply a pure earthy matter in suspension. Manganese oxide is sometimes used. Oxide of cobalt is used to secure blue or slate colours.

In order to apply the glaze to the piece it is only necessary to dip the piece into the glaze, protecting those surfaces that are to be left unglazed. If this latter is impossible, it becomes necessary to scrape the glaze off such parts after dipping. All parts on which the piece rests when placed in the saggers for firing must be left unglazed to prevent the piece from sticking to the saggers.

Placing in Saggers and Setting Kiln.—The sagger is a fire-clay vessel serving two purposes (*a*) to contain the ware, thus protecting it from direct contact with the fire. This is of first importance in coal-fired kilns ; (*b*) to allow of piling up the ware in order to fill the kiln.

The pieces to be fired are placed in saggers of proper size and shape, and the saggers are piled one above the other in "bungs" placed in circles around the kiln one row within another until the kiln is full.

At intervals about the circumference of the kiln, and in front of spy holes, are placed pyrometric cones for gauging the temperature. These can be examined by the kiln burner from time to time through the spy holes.

Firing Gas-Coal.—The firing of the kiln is one of the most important parts, if not the most important in the manufacture of any ceramic ware, and it is of more importance in the manufacture of high-voltage insulators than in many other ceramic wares.

There are two common fuels used for firing kilns, coal and natural gas. Hard coal is used in some factories, but soft coal is almost universally used where natural gas cannot be obtained.

Besides many little advantages in the way of convenience of handling the fuel, extra room not available when coal is used, freedom from smoke, &c., natural gas firing is greatly to be preferred over coal firing for several important reasons.

(*a*) All soft coal contains more or less sulphur, and a portion of this is burned into the glaze of pieces fired in a coal-fired kiln. The presence of this sulphur causes the insulator to arc over at a lower voltage than it otherwise would.

(*b*) It being much easier to regulate the several fires round a kiln when using gas than it is when using coal, the temperature all through the kiln may be kept more uniform, thus ensuring that all the insulators in that kiln will be brought as nearly as possible to a uniform state of vitrification.

(*c*) The surface of the glaze on an insulator fired in a gas-fired kiln will show a much nicer gloss than one fired in a coal-fired kiln.

The actual firing of a kiln takes about 40 to 48 hours depending on the size of the kiln, and also somewhat on the nature of the ware it contains. The smallest kilns are 12 ft. diameter and the largest are 16 ft. 6 in.

Nearly as important as the firing of the kiln is the cooling process. This must be regulated as nicely as the firing, or the glaze will be "off colour," crazed, or even the ware itself may be badly damaged. The time of cooling depends on the size of the kiln; a fair average for "setting," "firing," and "drawing," or one complete cycle for a kiln is about 80 hours.

Drawing Kiln and Sorting.—When the kiln has cooled sufficiently the saggers are removed and the ware taken from them and carried to the sorting room. All ware that is not "high voltage" is here sorted, the perfect being packed for shipment, the rejected being scrapped.

The high-voltage ware is also sorted here and pieces having visible flaws are thrown out. All others are passed on to the testing room.

Commercial Tests.—Pin Type Insulators.—The commercial tests on pin type insulators usually consist in inverting the parts in a pan of water of such depth as to cover the unglazed portion of the piece (or on head parts up to the centre of the side tire wire groove) and filling the inside of the piece to a depth to cover the unglazed part (in pin parts to cover the thread) and applying the potential to the water outside and inside. It is the practice to test all parts to a voltage just under the arcing point for a period of one minute.

All parts found defective are scrapped and the balance are sent to the assembling room.

Nothing but neat portland cement is used by the best makers in the assembling of insulators. Assembled insulators are tested in the same manner as above indicated. It will be readily seen that an assembled insulator tested in a pan of water will not stand as great a test as would be the case if mounted in its proper position on a pin, due to the fact that its total amount of leakage surface is not available. This applies also to the testing of single units of the suspension type.

Suspension Type Insulators.—The commercial test consists in treating each porcelain unit in the same manner as described above. Electrical tests on complete strings of suspension insulators are not made except as described in B and C below.

Dry Arcing Tests (B).—*Pin Type Insulators.*—This test consists in mounting the insulator on a metal pin under as nearly as possible service conditions and applying the potential to the pin and a rod fastened to the line wire groove in a manner similar to that in which the line wire would be secured.

It will be found that the arcing voltage thus obtained will be considerably higher than that obtained on an assembled insulator. The user should not confuse these two values, that is the commercial test on complete insulator (which is slightly less than arcing voltage in the test pans), and the ultimate arcing value as obtained by the test described in this paragraph.

Suspension-type Insulators.—Dry arcing tests on suspension insulators are determined by fastening the required number of units together and suspending them in position and applying the potential to the cap on the top unit and the wire clamp beneath the bottom unit. It must be borne in mind that the arcing voltage for several units is not a multiple of that for one unit of the same kind, although it has been found that each additional unit after the second adds about the same amount to the arcing voltage as the second unit added to the first.

Rain Arcing Tests (C).—*Pin-type Insulators.*—The rain test is at the best a very poor way of comparing insulators, due to the many variables entering into it. Quality of water, quantity of water, pressure of water, distance of nozzles from the unit under test, fineness of the spray, angle of contact with the unit under test, barometric pressure, and other matters have a bearing on the results obtained.

It has been generally found by careful experimenters, even with laboratory methods and apparatus, that it is practically impossible to duplicate results.

However, as used, generally to-day the rain test consists in mounting the insulator as described under "dry test" and throwing a fine spray on to it at an angle of 45° with the horizontal, the precipitation being approximately 1 in. in five minutes. The accurate measurement of the quantity of water introduces another difficulty and chance of error.

Suspension Type Insulators.—The rain test on suspension type insulators is made in a similar manner, *i.e.*, by throwing on to the assembled string of units suspended in position, a spray of water at 45° with the horizontal, with a precipitation of approximately 1 in. in five minutes.

Mechanical Tests.—Pin Type Insulators.—The usual test applied to pin type insulators consists in mounting the insulator on a rigid metal pin and applying a pull at the side tie wire groove in a direction perpendicular to the vertical axis of the insulator. In general, it may be said that any high-voltage insulator will stand a pull that will bend or break any metal pin with which it is likely to be used; 2,000 lb. is a safe figure to use in general.

Suspension Type Insulators.—The mechanical tests on suspension insulators consists in applying tension between the metal cap on the top of the unit and the connecting link beneath the unit.

The ultimate breaking load for suspension insulators varies according to design and runs from 4,000 to 20,000 or 30,000 lb.

Packing of High-Voltage Insulators.—Pin Type Insulators.—Unless otherwise specified, pin type insulators are always assembled complete before shipment, and it may be taken as almost a general rule that with all insulators for voltages up to and including 35,000, the packing will be in barrels. Special cases may require special packing. Insulators for 40,000 volts and higher are generally packed in open crates containing three insulators each.

Suspension Type Insulators.—It has become general practice to pack each complete suspension insulator consisting of 3, 4, 5, or 6 units, depending on the operating voltage, in one crate of such design that the whole assembly may be swung up into position on the tower or pole, and the crate then removed. The advantages of this method will at once appeal to the superintendent of line construction.

The above description is by Mr. J. A. Sandford, electrical engineer to the R. Thomas & Sons Co., of East Liverpool, Ohio, U.S.A., and substantially covers the processes and tests employed by his firm.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

WEST INDIES.—With reference to the notice in the ELECTRICAL REVIEW regarding certificates of origin required with goods shipped to the West Indies, in which it was pointed out that an attestation by a Notary Public or other authority of the signature of the firm was required, it is understood that at a conference recently held in Trinidad, at which delegates from all the West Indian Colonies concerned were present, a revised form of certificate of origin was drawn up for consideration by the respective Governments. The revised form provides for the acceptance of the certificate of the exporter without further attestation, where the goods are consigned direct from the country of origin.

AUSTRALIAN COMMONWEALTH.—The Customs authorities have decided that the Siemens' mercury contact treadle for railway signalling may be imported into Australia free of duty.

MOZAMBIQUE.—The Board of Trade have received information to the effect that for the purpose of providing funds for a railway in the Province of Mozambique, all goods imported through Customs offices in the district of Quilimane are to be subjected to a surtax of 2 per cent. *ad valorem;* goods re-exported or cleared in the coasting trade through the same Customs offices will also be subjected to a similar surtax.

CANADA.—The Canadian Customs authorities have issued the following decisions as to the duties to be levied under the preferentia tariff applicable to British goods:—Electric douches, also portable vibrators, such as Bee pedestal vibrators and Bee portable vibrators, adapted for scalp or body massage, 15 per cent. *ad valorem.*

NEW ZEALAND.—The New Zealand Customs authorities have issued the following decisions as to the duties to be levied on certain imported goods; the duties quoted are those applicable to British goods under the preferential tariff:—

Air-compressor, for starting Diesel oil engine, being unsuitable for other purposes	Free.
Cranes, parts of, viz.:—	
Wheels for carriage of travelling electric crane, with projection in centre of tires and flanges on each side (claimed as locomotive wheels) ...	20 % ad. val.
Electric appliances, viz.:—	
Vulcanite cleats for holding electric wire (claimed as insulating material)	20 % „
Coil tester, the Simpson, for testing electric coils...	Free.

FRANCE.—The Board of Trade have received through the Foreign Office a copy of a letter which has been addressed by the French Minister of Commerce to the British Chamber of Commerce in Paris, dealing with the regulations as to the marking of merchandise imported into France by firms having branch establishments in that country. In this letter the French Minister states that British houses sending goods marked with their name to their own branches in France will be allowed to replace the expression "importé d'Angleterre" by the name of the place of manufacture which is considered to be a sufficiently clear indication of the real origin of the goods. This concession is, however, to be allowed only under the following conditions:—(1) That the name of the place of manufacture is not accompanied by any statement which may lead to the belief that the goods to which it is applied are produced in France, *e.g.*, the mark "John Brown & Co., London

and Paris" is inadmissible; (2) that the branch in France is a selling and not a manufacturing branch; (3) that the letter heads, advertising matter, price lists, &c., of the French branch clearly indicates its nationality.

UNITED STATES.—A paragraph in the ELECTRICAL REVIEW some little time ago showed the rates of duty proposed to be levied under the new American tariff on electrical and similar goods. Since this paragraph was printed the tariff has been under consideration by the Senate, and the following shows the fresh alterations which have been proposed by that body:—

	Rates previously proposed.	Rates as amended by Senate.
Mica unmanufactured:—		
Valued at not more than 15 cents per lb.	30 % ad val.	4 cents per lb.
Valued at 15 and not more than 75 cents per lb.	" "	25 % ad val.
Valued at more than 75 cents per lb.	" "	20 "
Cut mica, mica splittings, built-up mica, and all manufactures of mica, or of which mica is the principal part	" "	30 "
Carbons for flame arc lamps not specially provided for ...	not shown separately	30 "
Manufactures of carbon not specially provided for	"	25 "
Telegraph, telephone and other wires and cables composed of metal and rubber or of metal, rubber and other materials; iron and steel wire galvanised	20 % ad val.	15 "

HONDURAS.—A new tariff has been passed, which was to come into force on August 1st last; the following is a statement of the duties affecting electrical and similar goods:—

	Dollars per ½ kg.
Insulators of glass or porcelain	'05
Wire of iron or steel	'15
" of copper or brass	'20
Electric bells	'15
Graphite in powder	'05
Scientific, &c., instruments not elsewhere mentioned	'25
Lamps of all kinds	'10
Miners' hand lamps	'05
Electrical machines	'15
Mining machinery	free
Motors for steam, electricity, &c.	'01
Electric batteries	'25
Tramway rails	'01
Telephones and accessories	'15

Note:—Dollar = 4s.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

18,250. "Trolleys for electric tramcars." H. H. S. FARMER. August 11th.

18,252. "Electric starting devices for internal-combustion engines." L. RENAULT. (Convention date, August 12th, 1912, Germany.) August 11th. (Complete.)

18,316. "Fluid pressure braking apparatus for electric railways and the like." J. W. CLOUD. August 12th.

18,321. "Telegraphy." UNITED TELEGRAPH AND CABLE Co., and W. M. BRUCE, jun. August 12th. (Complete.)

18,323. "Manufacture from refractory material of parts of electric glow lamps." E. PODZUS. (Convention date, August 12th, 1912, Germany. August 12th. (Complete.)

18,326. "Wireless telegraph receivers." MARCONI'S WIRELESS TELEGRAPH Co., LTD., and H. J. ROUND. August 12th.

18,349. "Telephone systems." W. AITKEN. August 12th.

18,355. "Electrodes for electric arc lamps." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) August 12th.

18,357. "Method of and apparatus for separating suspended particles from gaseous bodies by means of high-tension electricity." E. MÖLLER. (Convention date, August 13th, 1912, Germany.) August 12th. (Complete.)

18,367. "Means for and method of changing the frequency of alternating electric currents." A. M. TAYLOR. August 13th.

18,400. "Electric light ceiling fitting fitted with a special device to facilitate the fitting or removal of a glass or alabaster bowl or metal reflectors or the like." A. HIGGINS and S. GRIFFITHS. August 13th.

18,412. "Regulation of dynamo-electric machines." A. H. MIDGLEY and C. A. VANDERVELL. August 13th.

18,433. "Relays." R. ZEI and J. NARDIN. (Convention date, August 12th, 1912, Austria.) August 13th. (Complete.)

18,446. "Incandescent electric lamps." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) August 13th.

18,447. "Incandescent electric lamps." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) August 13th.

18,448. "Incandescent electric lamps." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) August 13th.

18,474. "Mercury motor electricity meters. S. HOLMWOOD and CHAMBERLAIN AND HOOKHAM, LTD. August 14th. (Complete.)

18,479. "Electric contact device for use on semaphores, small lifts, and the like." A. SCHALCH. August 14th.

18,502. "Transformers for high-frequency currents." G. MARCONI and W. S. ENTWISTLE. August 14th. (Complete.)

18,511. "Electrical apparatus for working a system recording the individual movements of a number of persons." E. E. HARRISON. August 14th.

18,517. "Method of insulating electrical conductors." J. A. HEANY. August 14th. (Complete.)

18,526. "Electromagnetic device for adjusting valves from a distance." B. BRUNS. (Convention date, August 14th, 1912, Germany.) August 14th. (Complete.)

18,543. "Reception and recording of telegraphic messages." H. P. OKIE. August 15th.

18,558. "Locking apparatus for locking electric light glow-lamps to holders." S. DAVIES and W. J. BODELL. August 15th.

18,609. "Lock-out telephones for party lines." C. R. MILLER. August 15th. (Complete.)

18,612. "Electric arc lamps." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) August 15th.

18,622. "Electric sealing wax melter." H. S. ELLIS. August 15th.

18,663. "Transformers." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) August 16th.

18,673. "Arrangements for exciting Röntgen-ray tubes." SIEMENS BROS. AND Co., LTD. (Siemens & Halske Akt. Ges., Germany.) August 16th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

MEANS FOR STARTING MOTOR ROAD VEHICLES. F. R. Simms and Simms Magneto Co. 9,924. April 26th.

MINERS' SAFETY LAMPS OF THE ELECTRIC TYPE. J. L. Hudson. 14,365. June 19th. (December 14th, 1912.)

ELECTRIC FURNACE FOR FIXING NITROGEN FROM THE AIR. E. K. Scott. 14,871. June 25th.

ELECTRIC POWER TRANSMISSION. J. G. P. Thomas and Thomas Transmission, Ltd. 17,180. July 23rd.

CONTROL OF ELECTRICALLY-OPERATED SELF-PROPELLED VEHICLES. H. B. Van Daalen and H. P. Schreiber. 17,306. July 25th.

LANTERNS. Graham & Latham, Ltd., and H. R. Latham. 17,589. July 29th.

ELECTRICAL WELDING OF WHEEL RIMS. Dunlop Pneumatic Tire Co., Ltd., and F. J. Keegan. 17,588. July 29th.

METHOD OF, AND APPARATUS FOR, ELECTRIC WELDING. R. Haddan. (Cleveland Welding and Manufacturing Co.) 17,749. July 31st.

PROCESS AND APPARATUS FOR THE ELECTRICAL SEPARATION OF BODIES IN SUSPENSION FROM GASEOUS FLUIDS. E. Moller. 17,840. August 1st.

ELECTRICAL RESISTANCES. J. Roothaan and Ferranti, Ltd. 17,980. August 3rd.

ELECTRICAL DRIVING OF RING-SPINNING AND DOUBLING FRAMES. Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke Ges.) 18,018. August 3rd.

PROCESS FOR THE MANUFACTURE OF HYDROGEN FROM METALS OR LOW METAL OXIDES AND WATER. Dr. F. Bergius. 19,002. August 19th. (October 23rd, 1911.)

FUSE DEVICES FOR ELECTRIC CIRCUITS. J. H. Tucker. 19,642. August 28th.

MAGNETO-ELECTRIC MACHINES. O. Bartschi. 19,963. September 2nd.

VARIABLE-SPEED DYNAMOS FOR USE IN STARTING INTERNAL-COMBUSTION ENGINES AND THE LIKE. H. Leitner. 23,278. October 11th.

ELECTRICAL CURRENT-LIMITING SWITCHES. H. J. Railing, J. Strachan and E. E. Hoadley. 23,917. October 19th.

METALLIC ARMOURING OF INSULATED ELECTRIC CABLES. A. H. Howard. 24,287. October 23rd.

MANUFACTURE OF CHANDELIERS AND LAMPS FROM BENT WOOD OR COMPRESSED FIBROUS SUBSTANCES. L. Timar and O. Denes. 24,647. October 28th. (October 27th, 1911.)

SYNCHRONOUS RUNNING OF ELECTRIC MOTORS. J. L. Routin. 24,751. October 29th.

RAILWAY SIGNALLING. H. W. Firth and E. W. Leake. 25,991. November 12th.

ELECTRIC RELAY APPARATUS. J. D. Taylor. 26,851. November 16th. (July 25th, 1912.)

ADAPTER HOLDER FOR USE IN ELECTRIC LIGHTING, POWER AND HEATING. C. C. Smith. 26,651. November 20th.

PRODUCTION OF INSULATING LAYERS OF COATINGS ON ELECTRICAL CONDUCTORS. J. Loewenthal. 27,651. November 30th.

STARTING ARRANGEMENTS FOR INTERNAL-COMBUSTION ENGINES. Ernst Eisemann and Co. and E. Eisemann. 29,291. December 19th.

APPARATUS FOR ELECTRIC WELDING. R. Haddan. (Cleveland Welding and Manufacturing Co.) 29,999. December 30th. (Divided application on No. 17,749 of 1912, July 31st.)

1913.

DEVICES FOR THE PRODUCTION OF INDUCED CURRENTS IN MAGNETO MACHINES, DYNAMOS AND OTHER INDUCTION GENERATORS. A. Keller-Dorian. 1,100. January 14th. (August 9th, 1912.)

PROCESS OF ELECTROLYSIS. H. M. Du Bois. 1,420. January 17th.

ELECTROLYTIC CELLS. H. M. Du Bois. 1,489. January 17th.

TRANSMISSION TO A DISTANCE AND RECORDING OF THEATRICAL PERFORMANCES AND THE LIKE. E. Chabeault. 1,444. January 17th.

COMBINED AUTOMATIC LOCKING DEVICE AND DETACHABLE LAMP CAP FOR LOCKING BAYONET-TYPE ELECTRIC LAMPS AND THE LIKE TO THEIR HOLDERS. H. T. Worrall. 2,139. January 27th.

TELEPHONE SYSTEMS. E. A. Graham and W. J. Rickets. 2,610. January 31st.

MAGNETIC SEPARATOR. Fried. Krupp Akt.-Ges. Grusonwerk. 4,595. February 22nd. (March 15th, 1912.)

ELECTRODEPOSITION OF METALS. N. H. M. Dekker. 7,328. March 27th. (Divided application on No. 17,886 of 1912, August 1st.)

STARTING INTERNAL-COMBUSTION ENGINES. W. C. S. Chapman. (Chapman.) 7,575. March 31st.

LUMINOUS INDICATORS FOR ELECTRIC SWITCHES. H. Wade. (Voigt & Haeffner Akt.-Ges.) 7,581. March 31st.

MEANS OF HOUSING THE RECORDING STRIP OF ELECTROCARDIOGRAPHS OR THE LIKE. Siemens & Halske Akt.-Ges. 7,846. April 3rd. (April 6th, 1912.)

PRINTING TELEGRAPHS. L. Cerebotani. 9,533. April 26th. (April 29th, 1912.)

BEARINGS FOR ELECTRICAL MEASURING INSTRUMENTS AND THE LIKE. Aron Elektricitatszahlerfabrik Ges. 11,277. May 14th. (December 14th, 1912.)

ARC LAMPS. H. E. Moul. (Korting & Mathiesen Akt.-Ges.) 11,704. May 20th.